Engineering Library


# The Engineer.

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VOL. CXLVIII.—No. 3838] LONDON: FRIDAY EVENING, AUGUST 2, 1929 [PRICE ONE SHILLING BY INLAND POST 1s. 3d.


PUBLIC NOTICES

## Crown Agents for the COLONIES.

COLONIAL GOVERNMENT APPOINTMENTS.

APPLICATIONS from qualified candidates are INVITED for the following POSTS :—

M/1384.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of NIGERIA for Railway Surveys for a tour of twelve to eighteen months, with possible extension. Free quarters and passages and outfit allowance of £60 on first appointment. Liberal leave on full salary. Salary £480 for three years, then £510, rising by annual increments of £30 to £720 a year, and thence rising by annual increments of £40 to £920 a year. Candidates, aged 25 to 35 years, must have passed Sections A and B of the examinations to qualify for the A.M.I.C.E. Diploma or hold professional qualifications recognised by the Institution of Civil Engineers as exempting from those examinations. Must have had experience on railway location.

M/1637.—ASSISTANT ENGINEER REQUIRED by the GOVERNMENT of TANGANYIKA TERRITORY for the Railway Department for a tour of 29 to 30 months' service, with possible extension. Salary £480, rising by annual increments of £20 to £600 a year, and thence by annual increments of £30 to £720 a year. Outfit allowance of £30 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates, 25 to 30 years of age, should have passed Sections A and B of the A.M.I.C.E. examinations or hold engineering qualifications accepted by the Institution exempting from those examinations, or be Student Members of the Institution. Should have had experience of railway construction and maintenance, and be well versed in the use of a theodolite and levelling instruments. Must be able to design structural steel work.

Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, London, S.W.1, quoting the reference number against the appointment for which application is made. 2791

## St. Helens Education Committee.

A FULL-TIME LECTURER in MECHANICAL ENGINEERING is REQUIRED for the St. Helens Municipal Technical School. Salary in accordance with the Burnham Scale.—Forms of application from the SECRETARY FOR EDUCATION, Education Office, St. Helens. 2766

BRIDGE COMPETITION.

## The Harbour Board of the City

of Stockholm hereby invites to take part in a PUBLIC INTERNATIONAL COMPETITION for DESIGNS for a ROAD BRIDGE over Lake Mälaren, in Stockholm.

The programme documents can be obtained from the REGISTRAT of the HARBOUR BOARD, Katarinavägen 13a, against a deposit of 50 crowns, which amount will be repaid either after a proposal in accordance with the programme has been handed in, or if all the programme documents are returned undamaged before 1st October, 1929.

A grant of 50,000 Swedish Crowns has been appropriated to the competition, of which amount 38,000 Cr. is intended for at least three prizes, of which the lowest is to be not less than 5000 Cr. and 12,000 Cr. is intended for the purchase of designs submitted but not awarded a prize, the purchase money for single design being not less than 3000 Cr.

The period for the competition expires on 1st February, 1930. 2765

## Great Northern Railway (IRELAND).

TO BRIDGE CONTRACTORS.

The Directors are prepared to receive TENDERS for the SUPPLY and DELIVERY of TWO PRESSED STEEL TROUGHING BRIDGES (total weight 23 tons) at Ballybay and Dungannon.

The drawing and specification may be inspected at the Engineer's Offices, Dublin and Belfast, or copies of same, with forms of Tender, may be obtained from the undersigned on payment of One Guinea, which will be refunded on receipt of a bona fide Tender.

Tenders, endorsed "Steel for Bridge Work," should be delivered under sealed cover not later than 10 a.m. on Monday, August 26th.

The Directors do not bind themselves to accept the lowest or any Tender.

F. C. WALLACE,
Secretary.

Amiens-street Station,
Dublin,
29th July, 1929. 2780

## Harbour of Waterford.

TO ASPHALT CONTRACTORS.

Sealed TENDERS, addressed to the undersigned, will be received up to, but not later than, Twelve o'clock Noon on the 14th August, 1929, for SUPPLYING and LAYING about 1700 SQUARE YARDS of NATURAL ROCK ASPHALT on the concrete deck surface of the Deep Water Wharf at Waterford.

For further particulars and copy of the specification apply to the Harbour Engineer, Harbour Engineer's Office, Waterford.

The lowest or any Tender will not necessarily be accepted.

AUSTIN A. FARRELL,
Secretary and General Manager.

Harbour Office, Waterford,
24th July, 1929. 2773

## The Assam-Bengal Railway

COMPANY, Limited, is prepared to receive TENDERS for :—

840 PAIRS WHEELS AND AXLES FOR CARRIAGES AND WAGONS.

Specifications and Tender forms may be obtained at the offices of the Company, Bishopsgate House, 80, Bishopsgate, E.C. 2. A fee of £1 1s. is charged for each specification, which cannot under any circumstances be returned.

Drawings may be had at the cost of the tenderer by application to Messrs. Hodges, Bennett and Co., Ltd., 78, Queen Victoria-street, E.C. 4.

Tenders must be delivered at the Company's offices not later than Noon on Thursday, 15th August, 1929.

The Directors do not bind themselves to accept the lowest or any Tender.

By Order of the Board,
THOS. C. BRETT,
Secretary.

29th July, 1929. 2764

## The Engineer

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PUBLIC NOTICES

## The Madras and Southern Mahratta Railway

COMPANY, LIMITED, invite TENDERS for :—

(1) SPARE PARTS for CARRIAGES and WAGONS (C.S. BRACKETS, DRAWBARS, BUFFER HEADS and CASINGS, COUPLING HOOKS, &c.).
(2) 1250 TYRES for CARRIAGES And WAGONS.
(3) 2184 AXLE-BOXES for CARRIAGES and WAGONS.
(4) 16,734 STEEL BOILER and FLUE TUBES.

Tenders are due in on Tuesday, 27th August, 1929, by 2 p.m.

Tender forms obtainable at Company's Office, fee One Guinea each, WHICH IS NOT RETURNABLE.

The Directors do not bind themselves to accept the lowest or any Tender.

Company's Office :—
25, Buckingham Palace-road, Westminster, S.W. 1. 2779

## Egyptian Government.

APPOINTMENT OF TECHNICAL OFFICE ASSISTANT.

APPLICATIONS are INVITED for APPOINTMENT as TECHNICAL OFFICE ASSISTANT in the MECHANICAL DEPARTMENT of the EGYPTIAN STATE RAILWAYS, TELEGRAPHS and TELEPHONES ADMINISTRATION.

Applicants must be of British nationality, between 25 and 35 years of age, and possess the following qualifications :—

Good theoretical and works training and some drawing-office experience, preferably in a railway company's works or locomotive builders.

Salary £E360 per annum (£E1 equals approximately £1 0s. 6d.), free of Egyptian income tax.

The appointment is subject to medical examination.

The selected candidate will be granted a transfer allowance equal to one month's salary for change of residence from England to Egypt and also vice versa.

Initial period of contract 3 years, subject to extension.

Third-class fares and reasonable out-of-pocket expenses will be paid to applicants who are requested to attend for interview and/or medical examination.

Application and specimen contract forms may be obtained from the

CHIEF INSPECTING ENGINEER,
Egyptian Government,
41, Tothill-street, London, S.W. 1,

to whom they should be returned, with full particulars as to education, qualifications, previous experience, personal references, and COPIES of certificates or testimonials.

Envelopes to be inscribed "Technical Office Assistant." 2760

PUBLIC NOTICES

## Swanage Urban District COUNCIL.

SEA WALL UNDERPINNING AND GROYNES.

TENDERS are INVITED for the UNDERPINNING of a section of the SEA WALL and the ERECTION of TWO TIMBER GROYNES.

Plans, specification and conditions of contract may be obtained on application to the Surveyor (Mr. F. Cambie).

Tenders, on the prescribed form, enclosed in sealed envelopes, must be delivered to the undersigned not later than Thursday, 29th August.

The Council do not bind themselves to accept the lowest or any Tender.

THOS. ARNOLD,
Clerk.

Town Hall, Swanage,
30th July, 1929. 2785

## Jodhpur Railway.

An ASSISTANT LOCOMOTIVE SUPERINTENDENT is REQUIRED for service on the Jodhpur Railway, India. Age should be about 25 years and applicants should be unmarried.

Candidates must have received their general education at a public school and should have had a good technical training, preferably at a recognised Engineering College, in addition to having served a proper apprenticeship in some well-known locomotive shops, either those of a British railway or locomotive builder, together with drawing-office and running department experience.

SALARY.—About Rupees 525 per calendar month, or according to age and qualifications, with annual increments of Rs. 50 per month, in accordance with Government scale; first-class free passage out and home again on satisfactory termination of services. The appointment will be on a three years' agreement in the first instance.

There will be a strict medical examination before appointment, and applicants should ascertain whether their teeth and general health are satisfactory before applying, in order to save trouble to all parties.

Applications may be made by letter only, and candidates must give therein full particulars of their career, stating their age and including list of departments where apprenticeship was served, together with short details of work performed, and length of time in each department, also particulars of subsequent experience, &c.

Letters to be addressed to the undersigned, accompanied by copies of testimonials, &c., not later than 31st August, 1929.

RENDEL, PALMER & TRITTON,
Consulting Engineers,
Appointments Dept.,
2794 13, Dartmouth-street, Westminster, S.W. 1.

PUBLIC NOTICES

## West Midlands Joint Electricity AUTHORITY.

APPLICATIONS are INVITED for the POSITION of CIVIL ENGINEERING DRAUGHTSMAN at a wage of £5 per week.

Applicants must be good draughtsmen with experience in civil engineering work and mass reinforced concrete construction. A knowledge of stress diagrams is essential, and applicants must be able to prepare bar diagrams, &c., for reinforced concrete work.

Applications, accompanied by copies of two recent testimonials, and, if possible, a specimen of work, should be addressed to the Chief Engineer and Manager to the Authority at the Central Administrative Offices, so as to reach him not later than Saturday, the 17th August, 1929.

H. F. CARPENTER,
Clerk and Treasurer.

Central Administrative Offices :
Phœnix Buildings, Dudley Road,
Wolverhampton.
30th July, 1929. 2763

## NORTHERN INDIA
ENGINEERING DEVELOPMENT.

Many huge projects are completed, others are under construction, and still more are under consideration. When tendering, remember that we have handled, inter alia, all the material for the Lloyd Barrage, the largest irrigation scheme in the world, and that WE HAVE THE EXPERIENCE to enable us to quote you the most favourable terms for CLEARING and DESPATCHING up country any quantity of material to any site required.

For full particulars apply, EASTERN EXPRESS CO., Ltd., Karachi; or to Messrs. FORBES, FORBES, CAMPBELL and CO., Ltd. (Managing Agents), 9, King William-street, London, E.C. 4. P 4329

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

## WANTED, CHEMIST OR ENGINEER OR CHEMICAL ENGINEER,

Having first-class experience in the manufacture of Silk by the Dry (so-called Acetate) Process.

Those having only experimental experience need not apply, as only a practical man is required who is capable (based on actual experience) of supervising a large plant.

Particulars should be given of the daily production of silk spun, and how many spinning machines installed or operated and how many spindles per machine, so as to give some indication of experience.

Salary £400 to £600 per annum or more, according to experience.

Write, Box A. 757, Willing's, 86, Strand, W.C. 2. 2746 A

WANTED, ENGINEER Who Has Been engaged in the Erection and Operation of CELLULOSE ACETATE PLANT.

Particulars required about size of plant.

High salary offered to the right man.

Write, Box C. 759, Willing's, 86, Strand, W.C. 2. 2745 A


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## SITUATIONS OPEN (continued)

WANTED on Large Housing Scheme near London, TWO ASSISTANT CIVIL ENGINEERS; must be experienced in all branches of Setting Out, Levelling, Measuring Up, and General Routine of Contractor's Office.—Reply, stating age, experience, and salary required, to Box 142, c.o. Brown's, 39, Tothill-street, S.W. 1. 2800 A

AN Opportunity Occurs in an Engineering Works in London for an ambitious young MECHANICAL ENGINEER, age 30/35, with a North Country training, practical works experience and first-class technical qualifications, preferably in connection with light engineering work. Must be good organiser, able works planner and have ability to get jobs done. The post offered is a progressive one to the right man, and will entail much hard work.—Write, stating age, experience, and salary required, together with copies of two recent testimonials. No application will be considered if these details are omitted. Without the necessary qualifications, please do not waste our time. —Z.R. 811, c/o Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 2778 A

ASSISTANT ENGINEERS (Temporary) REQUIRED in Engineer's Department, London County Council, with good technical training; good draughtsmen, able to use theodolite and level. Rate of pay from £5 to £6 approximately. Preference given to candidates who served or attempted to serve in H.M. Forces.
Write, stating age, training, and experience, to the CHIEF ENGINEER, Old County Hall, Spring-gardens, S.W. 1. Canvassing disqualifies. 2768 A

ASSISTANT ENGINEER WANTED for Oilfield in the Far East. Age 22-25. Must have served apprenticeship with some good general engineering firm. Sound theoretical training at some recognised technical college or school essential. Commencing salary £400 per annum, with free unfurnished accommodation. Five-year agreement; £50 outfit allowance.—Write, giving full particulars, to Z.A. 818, c/o Deacon's Advertising Agency, Fenchurch-avenue, London. 2776 A

ASSISTANT METALLURGICAL CHEMIST REQUIRED for Laboratory of Large Engineering Works in Midlands. Must have thorough experience on Steel and Non-ferrous Analysis.—Address, stating age, experience, and salary required, 2716, The Engineer Office. 2716 A

ASSISTANT WORKS MANAGER REQUIRED by Commercial Vehicle Manufacturers. Experience of modern methods of production and capable of controlling jig and tool designs office essential; must also possess first-rate organising ability.—Address, stating salary required, with full details of experience, 2782, The Engineer Office. 2782 A

BRANCH OFFICE MANAGER (English) WANTED for contracting business in Barcelona. Experienced in Boiler-house and Steam-raising Plant Construction. Knowledge of Spanish and capacity to control essential.—Write, giving age, experience, salary asked, to "G. O.," c/o J. W. Vickers and Co., Ltd., 24, Austin Friars, E.C. 2. 2767 A

CEMENT BURNER REQUIRED for Immediate service in Hong Kong, used to Rotary, preferable both Dry and Wet; 3 years' agreement. Free passages. Must pass medical examination.—Write, stating age, experience and salary required, to Box T. J. D., c/o Davies and Co., 95, Bishopsgate, E.C. 2. 2795 A

MACHINE TOOL SALESMEN.
TWO MEN REQUIRED, one for East Coast and one for South of England. Practical experience essential, men having the capacity and initiative to effect sales in new and rebuilt machine tools required. Liberal salary and commission.
MARTIN BROS. (MACHINERY), Ltd., Cornbrook, Manchester. 2771 A

MECHANICAL ENGINEER for Contractors for 12 months' service in the Far East. Considerable experience with usual Contractors' Plant on large public works contracts necessary.
Write, with full particulars of experience and stating age and salary required, to Box 115, c/o Brown's, 39, Tothill-street, S.W. 1. 2774 A

PRACTICAL ENGINEER REQUIRED, Experienced in Power-house Work, Coal-handling Plant, and Heavy Grinding Machinery; also in the Pneumatic Conveyance of Powdered Materials. State age, experience, and salary required.—Address, P6047, The Engineer Office. P6047 A

REINFORCED CONCRETE.—There are VACANCIES in Eastern Canada for experienced DESIGNERS. State age, experience and salary expected, Married or single; when at liberty.—Address, 2786, The Engineer Office. 2786 A

REQUIRED, an ENGINEER, Between the Age of 30 and 35 years, to assist the Production Engineer of a company employing about 800 hands on general engineering work. Main duty to co-ordinate designs with modern economical shop practice. Sound theoretical training and first-class shop experience essential, both in foundry, constructional and machine shop practice.—Box 129, c/o Brown's, 39, Tothill-street, S.W. 1. 2775 A

REQUIRED for Work in the Middle-East, ASSISTANT MECHANICAL ENGINEER. Age limit 21/25, single, with technical education, degree preferred in Steam, Internal Combustion Engines, Electricity, and Machine Drawing. Experience in Machine Shops and Drawing-office.
Applications should be in applicants' own handwriting, with COPIES ONLY of testimonials.
Address, 2772, The Engineer Office. 2772 A

WORKS MANAGER.—ADVERTISER REQUIRES experienced WORKS MANAGER for modern Motor Repair Works and Service Station. Gentleman preferred. Essential qualifications: previous experience, good organiser, hard worker.
Reply in confidence to Box No. 608, Dorland, 14, Regent-street, London, S.W. 1. P6053 A

WORKS MANAGER WANTED for the Production of High-speed Diesel Oil Engines. Experience of modern methods of production desirable.—Reply, giving age, experience, references, and salary required, J. and H. McLAREN, Ltd., Engineers, Hunslet, Leeds. 2707 A

YOUNG MAN (20-25 Years), with Experience in Offices of Engineering Works, preferably in rate fixing or costing department. Good opening for energetic man. London district.—Address, stating age, experience, and salary required, P6058, The Engineer Office. P6058 A

WANTED, Capable TRACER. Also to Make Simple detail drawings.—Address, P6059, The Engineer Office. P6059 A

WANTED, Experienced Heavy Steelwork and Constructional DRAUGHTSMEN.—Apply (letters only), giving full experience, salary required, and references, to C. S. ALLOT and SON, Consulting Engineers, 1, North Parade, Manchester. 2790 A

WANTED Immediately, Experienced MECHANICAL DRAUGHTSMAN, to complete special machine and detail; required temporarily, with possibility of permanency.—Address, P6062, The Engineer Office. P6062 A

WANTED in London, Competent DRAUGHTSMAN, to make scheme drawings in connection with Conveying and Mechanical Handling Plants. Experienced men only need apply. State age, experience, and salary.—Address, 2729, The Engineer Office. 2729 A

WANTED, TWO or THREE First-class DRAUGHTSMEN, accustomed to the design of Structural Steel Work and construction of Water-tube Boilers. Applicants must have had experience.—Address in first instance, stating age, salary required, and qualifications, 2739, The Engineer Office. 2739 A

# YARROW HOME and HOSPITAL
## FOR CHILDREN
## BROADSTAIRS.

**For the Early & Preventive Treatment of Disease & Convalescence after illness.**

In these days of high cost of living, people of limited means are sometimes placed in a difficulty when their children are ill or need operations and afterwards require a change of air and much careful attention during convalescence. It cannot be too well known that the Yarrow Home and Hospital for Children, Broadstairs, Kent, was founded specially for the children of those who are not too well endowed with this world's goods. At this Home a child recovering from illness or an operation, or needing a long course of medical or surgical treatment, receives, amid the happiest possible surroundings and companionship, careful nursing and attention, such as could ordinarily only be obtained at expensive nursing homes. There are beds for fifty boys between the ages of four and twelve years, and for fifty girls between the ages of four and fourteen years. In special cases these age limits may be exceeded by two years. The fee is one guinea per week and travelling expenses. Applications for the entrance of patients are welcomed from professional people, such as members of the Institution of Civil Engineers, architects, artists, authors, clergymen, members of the medical, legal, and other professions, members of scientific societies, officers of the Navy, Army, and Royal Air Force, officers of the merchant navy, school masters, university professors, &c. The London office is at 116, Victoria-street, Westminster, and the Secretary will be pleased to send full particulars to anyone who is interested.

## SITUATIONS OPEN (continued)

CHIEF DRAUGHTSMAN REQUIRED, Good Disciplinarian, fully experienced in Drawing-office Methods of large modern factory. Age about 35.—Apply, stating age, experience, and salary required, to the EMPLOYMENT SUPERINTENDENT, the Avon India Rubber Co., Ltd., Melksham, Wilts. 2763 A

DRAUGHTSMAN (JUNIOR), with General Rubber Works experience, for Edinburgh district.—Address, giving full particulars experience, age and wage required, 2758, The Engineer Office. 2758 A

DRAUGHTSMAN. — MECHANICAL-ELECTRICAL. Experienced in Design of A.C. and D.C. Motors. —Address, giving particulars of experience, age, and salary required, to 2570, The Engineer Office. 2570 A

DRAUGHTSMAN REQUIRED for Leading Automobile Concern, Coventry district. Give fullest particulars, including experience, age, and salary required.—Address, 2370, The Engineer Office. 2370 A

DRAUGHTSMAN, Senior, with First-class Experience of Steam Turbine design and details.—Apply, stating age, experience, and salary required, to MANAGER, Drawing-offices, B.T.H. Co., Ltd., Rugby. 2571 A

DRAUGHTSMEN, with Some Experience in Furnace or Conveyor Work, preferably with Engineering Degree, REQUIRED, Birmingham area.
Address in confidence, stating full particulars of age, experience, salary, P6056, The Engineer Office. P6056 A

ELECTRICAL DRAUGHTSMAN REQUIRED, with some mechanical experience. Age 22 to 25.—Apply, stating age, experience, and salary required, to the EMPLOYMENT SUPERINTENDENT, the Avon India Rubber Co., Ltd., Melksham, Wilts. 2762 A

ENGINEER (DRAUGHTSMAN), Accustomed to designing Reciprocating Deep Well Pumping Machinery, Estimating, &c. Good prospects for suitable applicant.—Address, stating age, experience, and salary required, 2493, The Engineer Office. 2493 A

EXPERIENCED CONVEYOR DRAUGHTSMAN REQUIRED; able to Initiate Design and Supervise Detailing. State salary and experience.—Address, 2798, The Engineer Office. 2798 A

FIRST-CLASS DRAUGHTSMAN WANTED for Cranes and General Engineering Work.—State age, experience, and salary required, to Messrs. RANSOMES and RAPIER, Ltd., 32, Victoria-street, London, S.W. 1 (marked "Draughtsman.") 2799 A

JUNIOR ENGINEER REQUIRED from September for about six months, in connection with new works.—Apply, with references and salary required, to the MID-KENT WATER COMPANY, Snodland, Kent. 2757 A

REQUIRED, Capable ASSISTANT for Drawing-office of Water-tube Boiler Manufacturers. Applicant must be used to control of men and be fully conversant with this class of work.—Address' stating age, experience, and salary required, 2739, The Engineer Office. 2739 A

REQUIRED for London Correspondence Institution, Young Man as TUTOR in CIVIL and MECHANICAL ENGINEERING. Subjects up to B.Sc. (Hons.) Standard. Sound theoretical training and some practical experience essential. Permanent whole-time position.—Address, P6066, The Engineer Office. P6066 A

SENIOR and JUNIOR DRAUGHTSMEN REQUIRED AT ONCE, accustomed to detailing Structural Steel Work.—Apply, stating age, experience, salary required, and when at liberty, to CHIEF DRAUGHTSMAN, Redpath, Brown and Co., Ltd., Trafford Park, Manchester. 2733 A

SENIOR and JUNIOR DRAUGHTSMEN, with experience Heating and Ventilating; good salary and prospects for energetic and ambitious men.—Write, CARRIER-ROSS ENGINEERING COMPANY, Ltd., Victory House, Regent-street, London. 2797 A

STRUCTURAL DRAUGHTSMAN WANTED by a Firm of Calcutta Structural Engineers; required for light and heavy work. Must have knowledge estimating. Unmarried, age about 25. Salary commencing Rs. 500 per month; 5 years' agreement.—Apply in writing, with full details of experience, to Z.P. 810, c/o Deacon's Advertising Agency, Fenchurch-avenue, E.C. 3. 2777 A

## SITUATIONS OPEN (continued)

TWO DRAUGHTSMEN are REQUIRED by First-class HEAVY MACHINE TOOL MAKERS in Manchester district; must be capable Designers with good all-round experience, and quick and accurate workers; capability and efficiency are first considerations.—Address, 2784, The Engineer Office. 2784 A

BRICKS AND TILES.—Experienced FOREMAN REQUIRED to manage Tile Works in India. Up to date practical knowledge of the manufacture of Roofing and Flooring Tiles and Bricks essential, also experience of continuous Kilns and Dryers. Must be able to supervise native labour. Applicants should be physically fit; age not over 35. Free quarters, passage and outfit allowance.—Write, giving full particulars of experience.—Address, 2793, The Engineer Office. 2793 A

## SITUATIONS WANTED

BRASSFOUNDRY MANAGER or FOREMAN DESIRES CHANGE; able to control and organise men to obtain the best results. Machine bench, floor, dry and green sand.—Address, P6051, The Engineer Office. P6051 B

CHARTERED CIVIL ENGINEER, with Wide Construction and management experience, now at home, WILLING PROCEED ABROAD, investigation and report Bridging, Tunnelling, Hydro-electric, or Modern Roads. Highest credentials, five languages.—Address, P6027, The Engineer Office. P6027 B

ENGINEER, Age 27, Good Education, Experienced in quantity production of small components to fine limits, automatics, small gear cutting and clock-work mechanisms, SEEKS POSITION with well-established concern, London area, as MANAGER or with view to PARTNERSHIP.—Address, P6029, The Engineer Office. P6029 B

ENGINEER (28), Six Years' Sea Experience Running and maintenance of Diesel engines, 1st Class B.O.T. Motor Certificate (1928), DESIRES POSITION ashore. Excellent refs.—Address, P6057, The Engineer Office. P6057 B

ENGINEER (30) SEEKS RESPONSIBLE POSITION. Public school education. Exp. shops, D.O., assistant engineer works extensions and maintenance.—BM/LO24, London, W.C. 1. P6060 B

ENGINEER, 22 Years of Age, with First-class Board of Trade Certificate, 12 years' practical experience TURBINES, RECIPROCATING, OIL FUEL, REFRIGERATING, &c., WOULD LIKE TO HEAR FROM ANY FIRM HAVING VACANCY FOR REPRESENTATIVE, or similar position.—Address, P6052, The Engineer Office. P6052 B

GENTLEMAN, Age 43, with Wide Commercial, manufacturing and selling experience, 15 years' managing director of works, travelled all parts and to U.S.A. and Canada, DESIRES CHANGE. London Representative, Secretary, or General Manager.—Address, P6063, The Engineer Office. P6063 B

MAINTENANCE ENGINEER. Expert on Plant construction, plant repairs electrical and mechanical, SEEKS POST with Quarrying Firm in the South of Scotland or England; good testimonials.—Address, P6055, The Engineer Office. P6055 B

WORKS SUPERINTENDENT, 3 Foremen and 100 men, DESIRES a CHANGE. Experience, all classes of machine tools, gas and oil engines and general engineering with rate fixing and toolroom experience.—Address, P6030, The Engineer Office. P6030 B


35% ORDERS GUARANTEED
FROM SOUND ENGINEERING ENQUIRIES. Exceptionally live ENGINEER SALESMAN, established connection LONDON (and provinces), SPECIALITY CONVEYORS AND ELEVATORS, structural and general engineering work, can offer the above guarantee, based on past experience, to well-established go-ahead company, in return for permanent position. Disengaged shortly.—Address, P6050, The Engineer Office. P6050 B



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"THE ENGINEER" Office, 33, Norfolk Street, Strand, W.C.


## PARTNERSHIPS

BANK OFFICIAL (retired) PROCURES CAPITAL for new or established companies from clients prepared to invest £2000 to £5000 each, with directorship. Proofs available of investments of £750,000 made by clients.—Write Box 1392, Pool's, 180, Fleet-street, E.C. 4. 2565 C

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# A Seven-Day Journal

## The Iron and Steel Industries.

The Committee which has been appointed by the Government to inquire into the iron and steel industry will take the form of a sub-committee of the Committee of Civil Research. It will consist of the Lord Chancellor, Lord Sankey (Chairman); the Secretary for War, Mr. Thomas Shaw; Sir Cecil Budd, Chairman of the London Metal Exchange and managing director of the British Metal Corporation; Mr. C. T. Cramp, general secretary of the National Union of Railwaymen; and Sir William Plender, of Deloitte, Plender, Griffiths and Co., chartered accountants. The terms of reference are to consider and report on the present position and prospects of the iron and steel industries, and to make any recommendations as to any action which may appear desirable and practicable in order to improve the position of these industries in the markets of the world. In order to promote the welfare of the iron and steel industry in the United Kingdom, a new company, limited by guarantee, with 500 members, has recently been formed under the style of the National Federation of Iron and Steel (Corporate Organisation), Ltd. It will co-operate with the voluntary organisation known as the National Federation of Iron and Steel Manufacturers to certify the origin, material, mode of manufacture, quality, accuracy, and other characteristics of iron and steel and goods manufactured therefrom, and will apply for trade marks which may be used by the organisation. The executive committee in which the management is invested includes Mr. A. O. Peech, Mr. H. E. Parkes, Mr. E. J. Fox, Mr. B. Walmsley, Mr. J. Craig, Mr. J. Henderson, and Mr. H. C. Bond.

## Salvage Work at Scapa Flow.

After a very smooth passage through the Pentland Firth, and down the eastern coast of Scotland to the Firth of Forth, the upturned hull of the ex-German battleship "Kaiser," in charge of three German tugs, the "Seefalke," "Heros," and "Hercules," reached Rosyth safely on Tuesday, July 23rd. The following day she entered No. 2 graving dock, and the work of shoring up the hull before pumping it out was begun. That work is now well advanced, and it is expected that the Alloa Shipbreaking Company, Ltd., will be able to begin dismantling operations very shortly. The departure of the "Kaiser" from Cox and Dank's depôt at Lyness Pier was delayed nearly two weeks by unexpected difficulties which were experienced in making secure the conning tower. This part of the ship was finally blasted away, and will eventually be recovered from the anchorage. As the "Kaiser," with her displacement of about 25,000 tons, is shorter than the ships previously raised, she is correspondingly deeper, and all her turrets had to be removed, so that she would pass easily over the sill of the graving dock. The work entailed was costly, but nevertheless some saving is being made on account of the smaller number of packing blocks needed for supporting the ship within the dock. Salvage operation on the small 4000-ton light cruiser "Bremse" are now in progress, and this ship, it is hoped, will be raised and delivered to a dry dock before the end of the season. Cox and Danks, Ltd., we are able to state, have recently purchased from the Admiralty two further battleships. They are the 27,000-ton "Prinz Regent Luitpold" and the 19,700-ton "Von der Tann." These vessels, together with the 28,000-ton "Hindenburg," will be dealt with next year.

## Proposed Road Bridge Across the Forth.

A preliminary report which has been prepared by Messrs. Mott, Hay and Anderson, of Westminster, under the instructions of the Ministry of Transport, has been sent to local authorities on the East of Scotland interested in the proposed road bridge over the Forth. From such particulars of the report as have been published, we gather that three sites were investigated, first, one practically a mile above the Forth Railway Bridge near to the Rosyth dredged channel; secondly, one close alongside the Forth Bridge; and, thirdly, one about a mile downstream from the bridge. This third site is recommended as being probably the most suitable, and a suspension type bridge has been recommended on the grounds of appearance and economy. The main span would be 2400ft. long, with side spans of 1040ft., and with a minimum clearance of 150ft. The land approaches to the bridge have already been surveyed. On the south side the road would branch off the Edinburgh–Queensferry road and would present no difficulties. Two alternatives are, however, given for the north side approach roads. The first of these and the shorter would wind round the eastern side of Garth Hill and would join the North Queensferry–Inverkeithing road, while the longer route would connect with the Inverkeithing road beyond the town, and would involve a high-level bridge over Inverkeithing Bay. It is estimated that the cost of the whole scheme with the shorter northern approach road would be about £5,570,000, while that with the longer northern approach road would amount to £6,110,000. Both these amounts would include an allowance of £50,000 for land and one of 15 per cent. for contingencies and parliamentary and engineering fees.

## The William Froude National Tank.

According to the annual report of the Advisory Committee for the William Froude National Tank, the continuous growth of the work of the Tank has caused anxious thought to be given to suggestions for obtaining increased testing facilities and for accelerating the work. Similar pressure at Hamburg has resulted in the construction of a new Tank, but at Teddington, although the land for such a purpose could be found, funds are not available. The selective restriction of test work was considered as a way out of the difficulty, but was not adopted. Some measure of relief has been obtained by examining the hull and propeller designs as received, and suggesting changes based on Tank experience without actually testing the designs. In spite of such relief, however, five definite orders for tests were withdrawn during 1928, and in several other cases test work, which would have come to the Tank, was withheld when it was realised that it could not be dealt with at a sufficiently early date. During the year 81 models of hulls, representing 59 designs, were tested at the Tank for private firms. In the four preceding years the models tested numbered 71, 63, 36 and 52 respectively. In one case a reduction of 16 per cent. in the power required for propulsion was secured by modification of the original design submitted by a firm. In three other cases reductions of 9 per cent. or over were secured. This pressure of mercantile research work resulted in no research work or type testing being done during the year on flying boats and seaplanes. An endeavour was made to maintain some research activity in connection with mercantile ships, partly by activities outside the Tank. It is of interest to note that of the time spent during 1926 and 1927 on the testing of ship models 55 per cent. was devoted to models of ocean-going cargo steamers, 19 per cent. to liners, and 8 per cent. to ferry boats and shallow draught steamers.

## Wages in the Engineering and Shipbuilding Trades.

On Thursday of last week, July 25th, a conference of the executive committees of the engineering trade unions was held in London to discuss the position arising out of the national claim for an increase of wages of 8s. per week, with a corresponding advance in piecework prices, which was put before the Engineering Employers' Federation on June 19th. At that meeting Sir Allan Smith, on behalf of the employers, suggested that the matter should be deferred until the end of the year, in order to enable the future prospects of the industry to be more clearly assessed. After a general discussion the conference decided, on Thursday last, to make an application to the Engineering Employers' Federation for a further conference to be held in the third week in September for the purpose of hearing a considered reply to the national application. The question of the trade and relations between Great Britain and Russia was discussed, and a deputation was appointed to wait on the Foreign Secretary, asking him to expedite the diplomatic negotiations now taking place in order to bring about closer trade relations. A sub-committee of the Engineering and Shipbuilding Trades Federation recently interviewed representatives of the Shipbuilding Employers' Federation in London and received explanations of the offer made in reply to the demand for a national advance in wages. It will be remembered that while refusing the national claim, the employers agreed to re-adjust the rates of pay to time workers and to consider the fixing of a general minimum. The report of the sub-committee will be submitted at an August meeting, at which the replies of the trade unions' executives will also be discussed.

## Pulverised Fuel at Sea.

The past week has been one of note in the history of the development of pulverised fuel for marine use. On Tuesday, July 30th, a party of engineers visited Avonmouth, on the invitation of Captain P. C. Grening, the director for Europe of the United States Shipping Board, in order to inspect the installation of the Todd unit system on the cargo steamer "West Alsek." An account of this ship will be found in our issue of July 19th. It was of interest to learn that an increased speed of 1½ knots had been attained, with a 10 per cent. saving in the fuel used, while the installation readily dealt with Scotch, Welsh and American coals. The visitors who joined the 'West Alsek" at Avonmouth crossed over to Cardiff on her, and had an opportunity of seeing the plant under actual sea-going conditions. On Wednesday, the following day, demonstration basin trials were carried out on the cargo steamer "Swiftpool," equipped with the Brand system of powdered fuel burning; this installation is described elsewhere in to-day's issue. On Thursday, August 1st, special trials were run on the Clyde of the self-trimming collier "Berwindlea," built by the Blythswood Shipbuilding Company, Ltd., at Scotstoun, for the Berwindmoor Steamship Company, Ltd. This steamer is a notable example of modern coal-carrying practice, and she was engined by David Rowan and Co., Ltd., of Glasgow. Her boilers are fired on the Clarke-Chapman system of pulverised fuel burning, embodying all the latest improvements. We hope to refer further to this installation in a forthcoming issue. Another recent Clyde development is the application of the Yarrow pulverised fuel system on the steamer "Amarapoora," belonging to P. Henderson and Co., Ltd., of Glasgow, and also to an experimental works boiler designed for a working pressure of 1200 lb. per square inch.

## Charing Cross Bridge.

At a meeting of the London County Council, held on Tuesday, July 30th, and at a meeting of the shareholders of the Southern Railway Company held the same day, the provisional agreement for the construction of the new road bridge over the Thames at Charing Cross, and the transfer of the Charing Cross Station to the south side of the river was approved. The details of the scheme were outlined in last week's Journal note. It now remains for the London County Council to seek Parliamentary powers enabling it to proceed with the scheme, and if all goes well, it is expected, according to present estimates, that the new bridge and station will be completed within a period of five to six years. The total cost of the scheme is £12,500,000, to which the sum of £946,000 remains to be added for the reconditioning of Waterloo Bridge, making a total of £13,446,000. Of this amount the Government has undertaken to contribute 75 per cent., leaving the remainder to be met by the ratepayers of London.

## Gun Explosion on Board H.M.S. Devonshire.

It is with great regret that we have to record a serious gun accident, which took place on Friday of last week, July 26th, on board H.M.S. "Devonshire" during firing practice in the Eastern Mediterranean, in which seventeen lives were lost, and other injuries inflicted. According to an official Admiralty report, it has now been ascertained that the cause of the accident was a hangfire of very short duration in one gun of an 8in. turret. Owing, it is stated, to the simultaneous discharge of other guns in the ship, including the other gun in the same turret, it was probably momentarily thought by the gun member controlling the breech mechanism that the gun in question had also fired, and the operation of reloading was therefore commenced. It appears probable, the report further states, that the mistake was almost immediately discovered, but that before it ould be fully rectified, the charge in the gun exploded, and blew out the breech block, which was then partly unlocked. The great force of the explosion also ignited cordite charges in their containers, which were waiting ready for loading for the next round. H.M.S. "Devonshire" will shortly sail for England in order that repairs may be carried out. She is, it will be recalled, the second of the four 10,000-ton ships of the 1925 cruiser programme, and was launched at Devonport Dockyard in October last year.

## The "Vestris" Inquiry.

Judgment was delivered on Wednesday, July 31st, by the Board of Trade Tribunal, under the presidency of Mr. Butler Aspinall, K.C., Wreck Commissioner appointed to inquire into the loss of the steamer "Vestris," which sank in November last off the American coast, with a loss of 112 lives. The court found that contributory causes of the disaster included overloading, the tender condition of the ship, leaks from the starboard ash ejector and hatches, water finding its way into the coal, and the non-fitting of wing sections in all the ballast tanks. In a judgment which takes the form of answers to fifty-eight questions put to the court by the Board of Trade in sittings which extended over forty days, we can in this note only single out the principal findings. The evidence is characterised as generally unsatisfactory. In the opinion of the Court, the S O S signal should have been sent out earlier, and some criticism is made of the order of the lowering of the port and starboard boats. While the owners are generally exonerated from blame, some blame is attributed to the New York agents of the owners and their officials for not taking adequate measures to ensure that the vessel was not loaded below her marks. The recommendations made include the suggestion that foreign-going passenger ships should be afforded the same protection as regards safety of life at sea as is now given to emigrant ships by the Board of Trade supervision and inspection. It is further suggested that the draughts of British vessels sailing from foreign ports should be officially observed and reported to the Board of Trade. The fitting of wing suctions to all ballast tanks having longitudinal divisions is considered necessary, and special attention should, it is held, be given to the construction of all hatchways, coal trunks and shoots, &c., through which water might gain access to the ship. It is also proposed that the boat list should be prepared and the boat stations exercised before sailing.

# Transformer Tap-Changing on Load.

No. IV.*

The British Electric Transformer Company's method of tap changing under load is shown applied to a delta-star connected transformer in Fig. 28, where it will be seen that, in accordance with common practice, the tappings are in the neighbourhood of the middle of the high-tension windings. On each phase the tappings are connected to the contacts of a selector switch—Figs. 29 and 30—comprising two bars which can be connected to the tapping contacts by two movable parallel brushes which are insulated from each other and are arranged so that they can both bear on the same contact or on adjacent contacts as well as on adjacent bars, as shown in Fig. 28. The dimensions and spacing of the contacts and brushes are such that, as the brushes are moved along the switch, the leading one reaches the second contact, while the other brush is still on the first contact and the insulation between the contacts is maintained as the leading brush passes from one contact to the other. The bars belonging to the switch are connected to the ends of an auto-transformer through single-pole oil switches, shown in Figs. 31 and 32, whilst the middle point of the auto-transformer is connected to the other portion of the transformer winding—Fig. 28. Referring to the key diagrams 1–5 in this illustration, the first of these diagrams shows the No. 1 position whilst diagram No. 2 shows the first change in the connections. It will be seen that one of the oil switches is first opened and that one of the brushes takes up a position midway between the first and second tapping contacts. The load is then carried by the other brush and one half of the auto-transformer which momentarily acts as a hoking coil. In the diagram No. 3, the leading brush has moved to the next contact. A moment after it has done so, the diverter switch closes and the second running position is reached. The auto-transformer is now connected across two adjacent transformer tappings and a virtual tapping point is given midway between the two main transformer tappings. The diagram No. 4 shows the midway position to the next step, the left-hand diverter switch being opened and the selector switch having moved to a point between the two contacts, this also being a transitional position with the other half of the auto-transformer acting as a choking coil. At the next step, No. 5, the two brushes are again bearing on one contact and both diverter switches are closed. One or other of the parallel circuits, it will be noted, is opened during a tapping change by means of an oil diverter switch before the movement of the selector switch commences, and consequently any sparking that may occur is entirely dealt with by the diverter switch. As the name implies, the diverter switches only divert the load into one of the two circuits, and consequently the maximum possible load which they are required to deal with is only a fraction of the transformer load. Each part of the equipment has been designed on liberal lines, so that in the event of a voltage change that has commenced, failing to be completed, even at full load, there will be an ample margin of time before dangerous overheating will occur. The apparatus has been designed so that it can be mounted in very compact form on the top of the transformer tank, as shown in Fig. 33, thus avoiding interference with the tank cooling and the symmetrical arrangement of the tank. Moreover, any even number of steps up to twenty can be provided, and in all cases only four leads per phase have to be brought through the tank cover, and all these leads are entirely protected and oil immersed.

The equipment for a three-phase transformer consists—see Figs. 34 and 35—of three oil switches, one for each phase, and each having two sets of independent contacts with outside operating levers. By means of adjustable connecting-rods, to be seen in Fig. 34, the contacts are mechanically coupled together in two groups of three, and the operation of these diverter switches is effected through two tripping mechanisms which are mounted on the oil switch nearest to the step-by-step operating gear, as shown in Fig. 35. Electrical interlocks associated with the tripping mechanisms complete an alarm circuit as soon as a group of diverter switches opens, and interrupt this circuit as soon as the group of switches has been closed. All the working parts of each unit are bolted to the lid of the oil switch tank and can easily be lifted out of the tank for inspection by means of a small jib—see Fig. 34—which can be mounted at the side of any one of the three tanks. The connections from the switch contacts to the interior of the transformer are made through insulators by means of self-aligning draw-out type plugs and sockets.

A motor-operated step-by-step mechanism ensures the opening and closing of the oil switches in the correct sequence. A squirrel-cage three-phase motor rated at 1 horse-power and a magnet-operated brake are mounted in a cast iron ventilated case with movable inspection doors, and the motor and brake are controlled by two triple-pole oil-immersed reversing contactors in a removable tank bolted to the outside of the case containing the motor. Above the motor casing is a cast iron tank containing oil-immersed gearing, the motor being coupled to the gearing through a roller chain drive and a three-start worm and worm wheel shown at A in Fig. 36, the

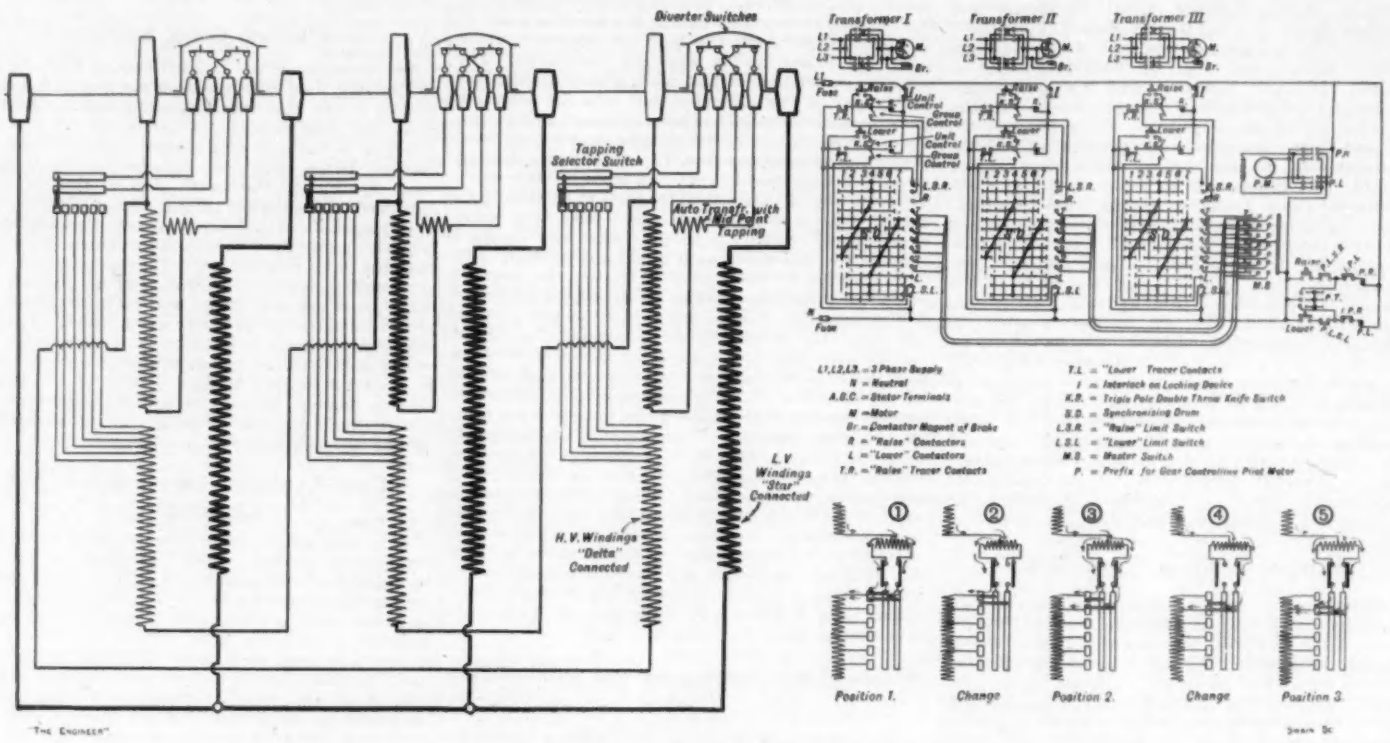



FIG. 28—DIAGRAM OF CONNECTIONS

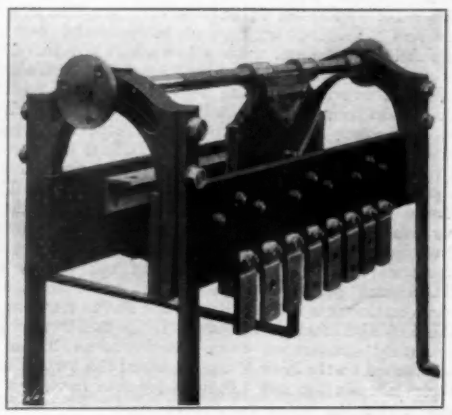


FIG. 29—SELECTOR SWITCH

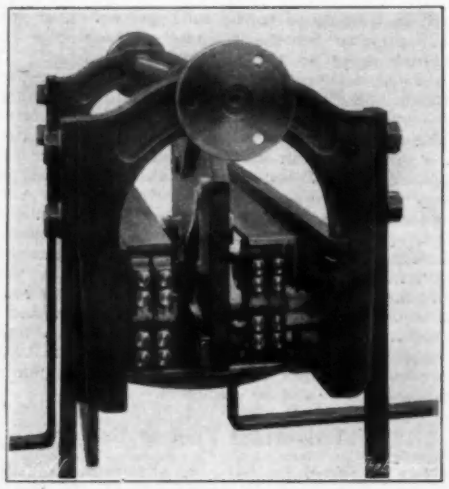


FIG. 30—END VIEW OF SELECTOR SWITCH

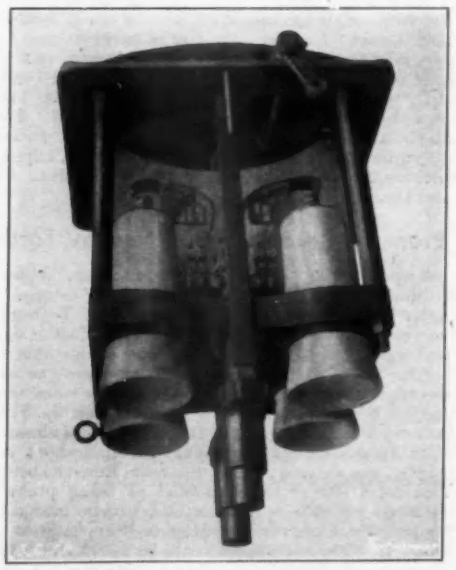


FIG. 31—DIVERTER SWITCH

* No. III. appeared July 26th.

latter being keyed to a steel shaft which also carries three-speed spur wheels B C and D, Fig. 37. The two spur wheels at the extreme ends of the shaft drive through pinions E, F and G, the cranks H and J which operate the two groups of oil switches, whilst the spur wheel C drives through the pinion F and bevel gear K the shaft L, to which the selector switch spindle is connected by means of another roller chain drive. The spur gearing is arranged so that as the common shaft rotates through one-sixth of a revolution one of the spur wheels rotates the pinion to which one of the diverter switch cranks is connected through 180 deg., thus opening the switches and locking the pinion in this position. The central spur wheel then rotates the corresponding pinion driving the selector switch and locks it in position. The first-mentioned spur wheel then comes into action again and recloses the diverter, locking the pinion as before after completion of the cycle. A similar sequence of operations is performed when the gear is operated through a second step in the same direction, but in this case the spur gearing at the other end of the shaft comes into operation, thus opening and closing the second group of diverter switches. Two sets of tracer contacts M and N—Fig. 36—are also operated from the common shaft, the object of these contacts being to maintain the circuit to operating coils of the raise and lower contactors as soon as the movement from one step to the next has commenced and to interrupt this circuit after the step has been completed, thus ensuring that the

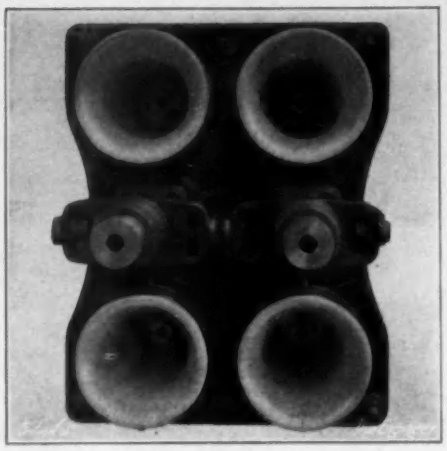


FIG. 32—DIVERTER SWITCH

insulated square steel bar. The segments which prevent further movement of the gear beyond the two end positions are also on this drum, but these segments are arranged so that the final interruption

is made possible by means of a dog clutch—Fig. 36—which is actuated by an external operating lever, and which disconnects the motor and connects the hand wheel shaft to the mechanism.

The selector switches are mounted inside the transformer tank, and each of these switches consists of an appropriate number of contacts associated with the transformer tappings. The contact bars bridge between two insulating panels, carried at either end by brackets, and on the inside of each panel and above the contact bars two longitudinal common return bars are mounted, whilst between them a number of contact fingers mounted on either side of an insulating base can be moved by means of a worm and nut drive. According to the position of the sliding members, one or the other of the contacts or two adjacent contacts will connect to the two common return bars, and thence to the ends of the auto-transformer, which is fixed to the framework of the transformer adjacent to the corresponding selector switch.

The whole of the equipment is suitable for outdoor mounting, and ball bearings are provided wherever advisable. All similar parts are interchangeable, and mechanical parts exposed to the weather are made of gun-metal or rustless steel. Remote unit control can be obtained by a set of push buttons enclosed in a cast iron case. There are two push buttons which may be locked to prevent unauthorised use, one of the buttons being marked "Raise," and the other "Lower." A position indicator mounted

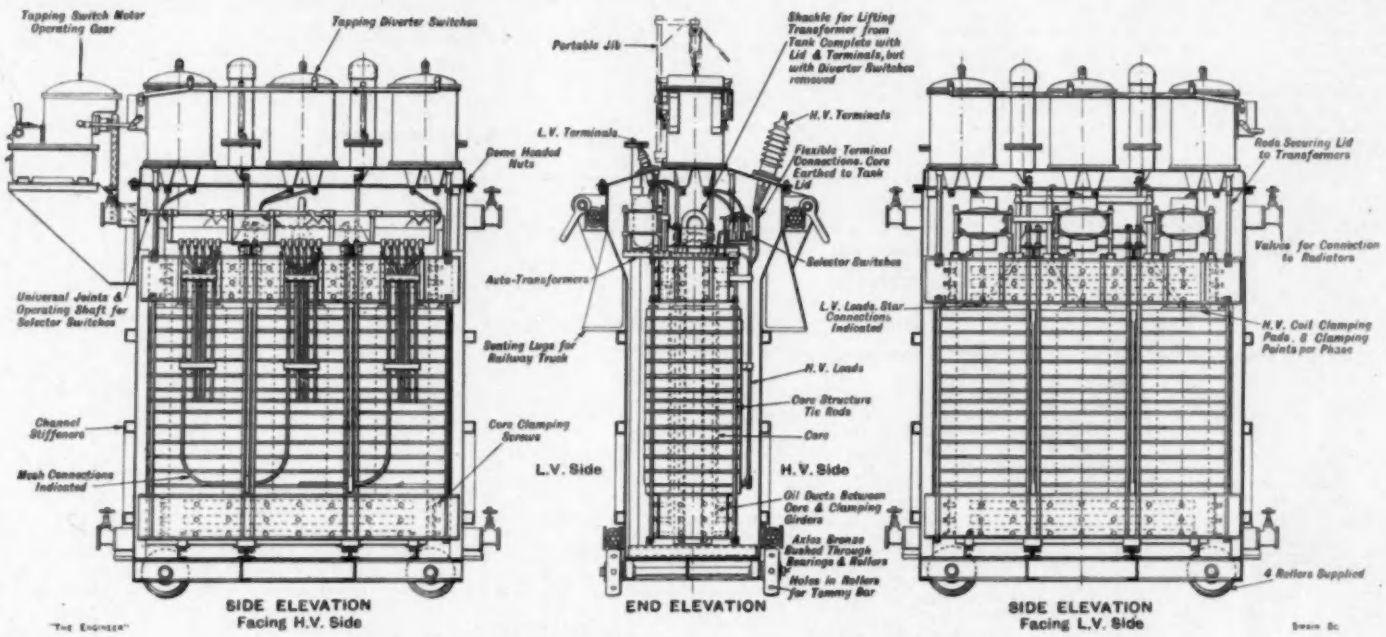

Tapping Switch Motor Operating Gear
Tapping Diverter Switches
Dome Headed Nuts
Universal Joints & Operating Shaft for Selector Switches
Channel Stiffeners
Mush Connections Indicated
Core Clamping Screws
SIDE ELEVATION
Facing H.V. Side
Portable Jib
Shackle for Lifting Transformer from Tank Complete with Lid & Terminals, but with Diverter Switches removed
L.V. Terminals
H.V. Terminals
Flexible Terminal Connections. Core Earthed to Tank Lid
Selector Switches
Auto-Transformers
L.V. Leads, Star Connections Indicated
Resting Lugs for Railway Truck
H.V. Leads
Core Structure Tie Rods
Core
L.V. Side
H.V. Side
Oil Ducts Between Core & Clamping Girders
Arlos Bronze Bushed Through Bearings & Rollers
Holes in Rollers for Tommy Bar
END ELEVATION
Rods Securing Lid to Transformers
Valves for Connection to Radiators
H.V. Coil Clamping Pads, 8 Clamping Points per Phase
4 Rollers Supplied
SIDE ELEVATION
Facing L.V. Side

FIG. 33—TAP-CHANGING GEAR FITTED TO THE TOP OF A TRANSFORMER

mechanism is not left in a half-way position. A cylinder of insulating material with a number of copper segments attached to it—Fig. 38—forms the control drum, which is geared to the common shaft, the rubbing drum fingers being carried on an

of the control circuit always takes place on the tracer contacts. At one end of the drum is mounted a position indicator disc, which can be seen through a circular window in the casing. A transmitter for a remote position indicator is also provided. Hand operation

in a metal case with a glass window and suitable for wall mounting and giving the indications by a pointer moving over a scale or by lamp signals, is supplied. If it is desired simultaneously to control two or more transformers operating in parallel, a

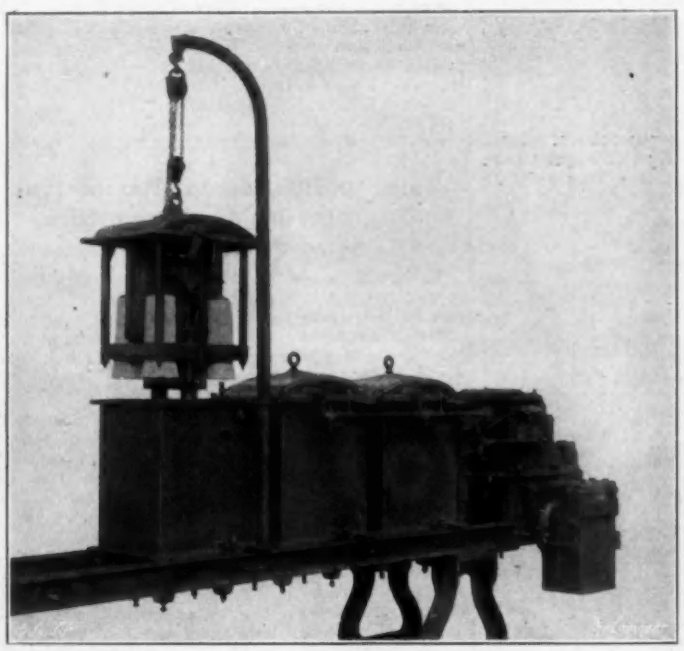


FIG. 34—DIVERTER SWITCHES AND OPERATING GEAR

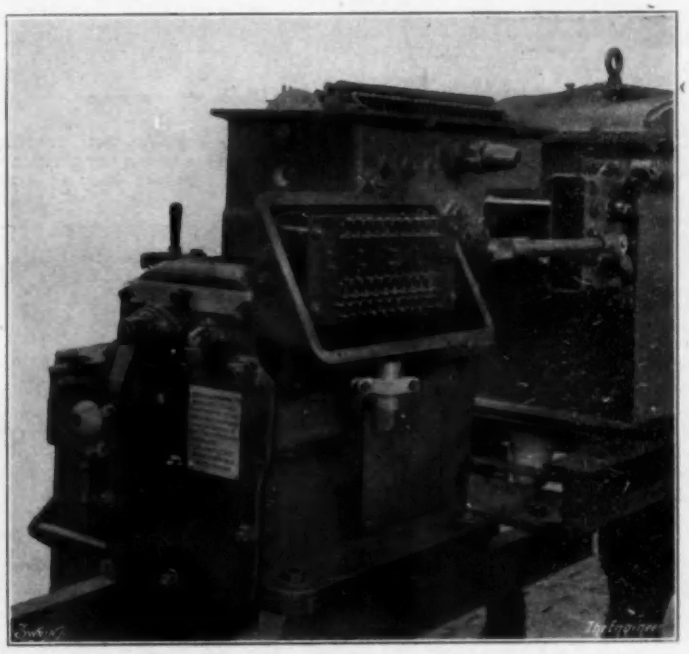


FIG. 35—SWITCH OPERATING GEAR

double-throw ironclad change-over knife switch is provided for each transformer, in addition to the push-button equipment; also a master switch for controlling a maximum of four transformers in step. By means of the change-over switch, the control of each transformer can be transferred from unit control by the press buttons to group control by the master switch, or *vice versâ*. While the master switch is usually hand-operated, it can be provided with a small pilot motor for remote push-button control.

Although it does not purport to be absolutely final, the method of control is shown diagrammatically in the upper right-hand corner of drawing, Fig. 28, where three equipments are illustrated. The three-phase supply to the control motors is indicated at $L_1$, $L_2$, and $L_3$. At L and R below there are three-pole contactors which connect the motors to run in the lowering and raising directions. Magnet-operated brakes for the motors are marked B R. The control circuit $L_1$ to N is connected between one phase and the neutral. A double-throw knife switch K S, provided for each unit, enables the attendant to select alternative controls for each transformer. If this switch is closed in the position marked unit control, then the corresponding transformer can be regulated by push buttons marked "Raise" and "Lower"; if the switch is closed in the position marked "Group control," the push buttons become inoperative, and the tap changer of the corresponding transformer will move at once into the step selected on the master switch M S, and thus into the same step as the other transformers of the sub-station, which may already be under the group control.

Assuming that the knife switch K S is in the position marked "Unit control," if the push button marked "Raise" is depressed a circuit will be established from $L_1$ through the fuse, the interlock I, the coil of the raise contactor R, the blade of the knife switch, the "Raise" push button, the limit switch L S R of the drum S D, and through the other fuse to N. When the raise contactors R close the motor brake is released, and the motor starts to rotate the gearing in the "Raise" direction, and closes the tracer contact T R which maintains the control circuit until the step has been completed, although the push button may have been released, thus ensuring that the tap changer cannot be left in any position between steps. By opening the appropriate push button circuit, the limit switches at L S R and L S L prevent any further movement of the switch beyond the end position in either direction, the fingers leaving the segments provided on the drum for this purpose. Accurate stopping of the motor is ensured by the magnet-operated brake, which closes as soon as the contactors open the circuit to the motor.

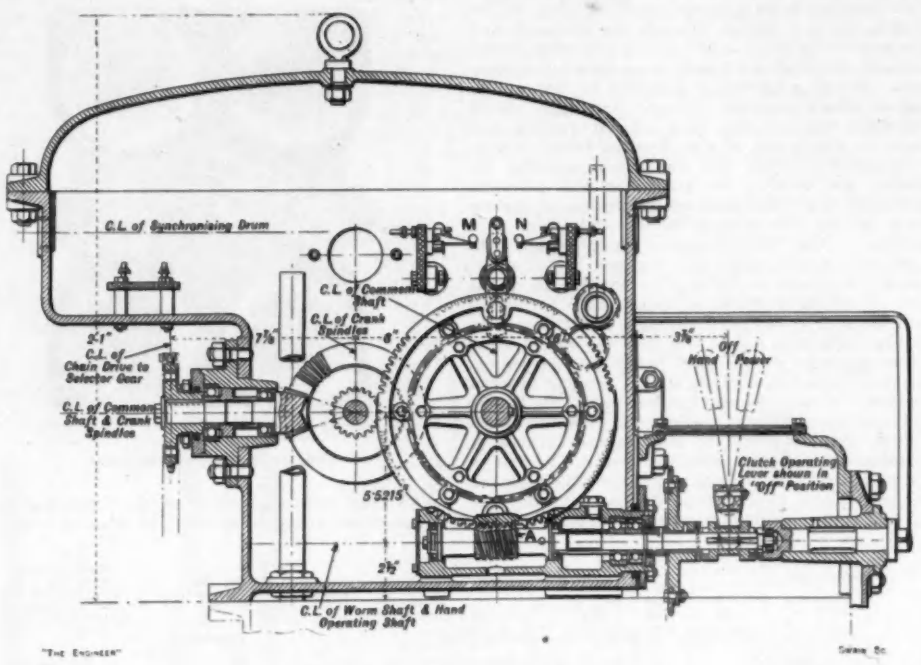



FIG. 36—OIL-IMMERSED GEARING

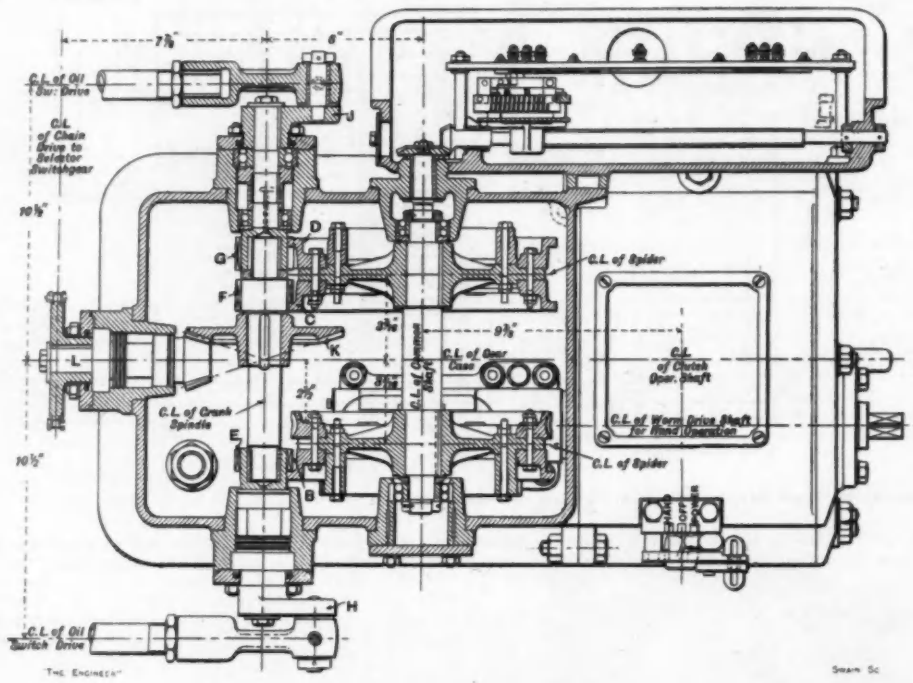



FIG. 37—PLAN OF GEARING

Let it be assumed that the knife switches are thrown into the position marked "Group control," and that the master switch M S is in the position 4, while the unit under consideration is at the lowest voltage position, say, step No. 1. The circuit is then immediately made from N, through the fuse, contact No. 4 of the master switch M S, finger No. 4 of the drum controller S D to the finger R, the switch blade, the coil of contactor R, through the interlock I, and the fuse to $L_1$. As in the case of unit control, the motor will now start, and the tracer contact T R will maintain the circuit until just before step No. 4 has been reached, when the drum finger No. 4 will leave the segment, so that the accurate stop will again be ensured by the tracer contacts. All the transformers connected to the master switch and having their respective knife switches thrown into the "Group control" position, will thus be controlled in step. The remote control of the master switch may be effected by means of a pilot motor P M, operated through the three-pole reversing contactors P R and P L, by means of push buttons. If, however, automatic control be required, the push buttons would be replaced by a voltage relay, or by the provision of a change-over switch, both methods of control might be employed. The time taken for the completion of a voltage step is approximately four seconds, and when operating transformers in parallel the maximum possible lag or lead of one transformer in relation to another is not more than a fraction of a second.

*(To be continued.)*

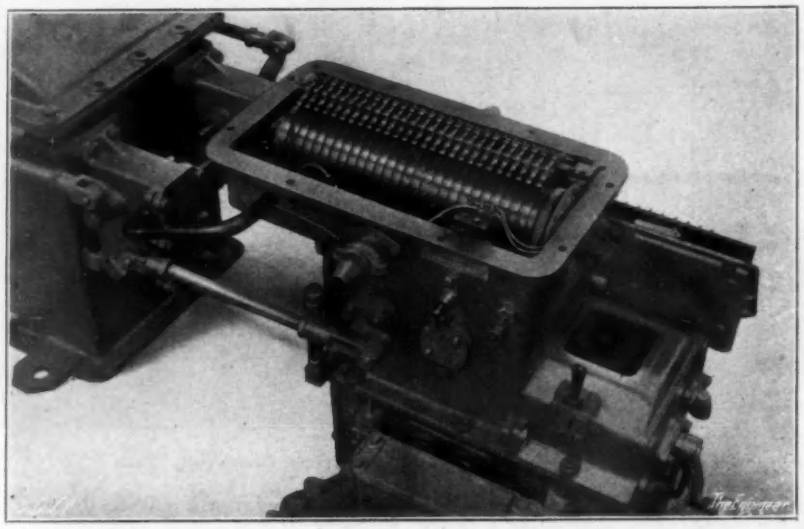


FIG. 38—CONTROL DRUM

## The Application of Mechanical Engineering to Agriculture.

By J. G. B. SAMS, A.M.I. Mech. E.

As agriculture is the oldest and greatest industry in this country, it might be thought that mechanical science had reached a high state of development in assisting the farmer with his laborious round, but a close inspection will show that there is much room yet for new and improved mechanical appliances, and for a greater trust in the engineer, if, indeed, costs of production are to be lowered, as they will have to be if the farmers are successfully to compete in the open market. Farming is much the same all the world over, and its conservative tendencies are well known. It can be said to consist of ploughing and otherwise scarifying the land with a view of killing out the weeds—colloquially termed "rubbish"—and preparing it as a seed bed; sowing the crops and removing the weeds from among the growing plants; cutting, carrying, and stacking the crops when fit; and threshing out the grain or utilising the stored crop as fodder of sorts for the livestock. At the same time a certain amount of fodder is grown for direct feeding, *i.e.*, direct from field to beast. Cattle are kept not only with the view of fattening and selling for food, but also together with the horse strength, of converting the straw of the grain stuffs into the necessary manure.

The following discussion is limited to the larger

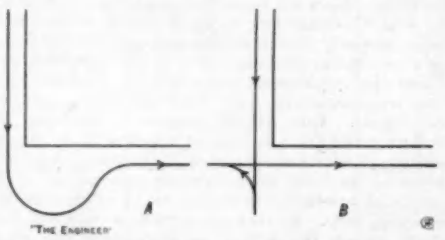
farms and fields, the use of some of the implements discussed being an economic impossibility on smaller farms and fields, in the first place, on account of capital cost, and, in the second, on the score of lack of working space. Before the war, when conditions were easier, some of the more progressive farmers had started to remove some of their hedgerows and accompanying ditches in order to make two small fields into one large one, more suitable to the use of modern mechanical appliances as well as to bring a little more land into cultivation, but this seems to have dropped out recently, presumably owing to greater expense. However, it might be possible to resume this work, given some form of machine in connection with cable tackle for stubbing-up roots and levelling the ground by pushing the hedge-bank into the ditch.

*Ploughing.*—We start, then, with the plough. Even to-day the greater amount of ploughing is performed by the single-share plough drawn by a team of two or more horses, the usual team being a pair, increasing up to four on the stiffer clay lands. The capacity of a ploughman and a team of horses cannot be any better than the yoke of oxen of Old Testament times, and remains at 1 acre per day—7 a.m. to 3.30 p.m.—by which time both men and horses have had enough. Successful steam and internal combustion plant for ploughing is in daily use, but the several disadvantages from which they both suffer seem to militate against their increased use. Here it may be said that the term "tractor" is used throughout the discussion to refer to the present style of combined internal combustion—petrol or paraffin—engine and chassis, or its slight modification; the term "cable tackle" being applied to the double engine system—steam or oil-driven—which draws the implement to and fro between them by means of cables and drums. Cable tackles suffer from being expensive outfits, requiring two heavy engines, and are only adapted for a limited number of operations. Owing to the great weight of the engines—up to 16 tons each—the farmers will often complain that in the wetter seasons the wheels crush the nature out of the soil, so that nothing will grow in their tracks for the next year or so, and in dry seasons the supply of the necessary water is often an expensive and difficult problem. These engines are usually hired out to the farmer at so much per acre, the farmer finding coal and water. In addition to ploughing, cable tackle is used for "cultivating," which consists of tearing up the land in chunks by means of an enormous harrow-like appliance having curved teeth with their ends flattened out into spearheads; for "subsoiling," or deep ploughing for about 12in. with simultaneous loosening of the subsoil by means of curved tools with chisel ends, this method being favoured for potato cultivation; and for "mole draining" the heavier lands by means of a "torpedo" about 4in. in diameter suspended by a braced arm from an heavy wheeled frame above ground. This torpedo is dragged through the soil at a depth of 2ft. or more, and run out into the ditch at the field side, the hole made lasting as a drain for about six or seven years, after which it will probably be necessary to repeat the operation. In all these operations one engine must always be idle, while the other is acting as a winch winding the implement in, and here steam has an advantage over the oil engine, as the winding engine can be temporarily over-driven, recuperating when the opposite engine is acting. Endeavours have been made to work with a single engine and an anchored pulley on the other side of the field, but this system never achieved much success, and has dropped out probably on account of the trouble in moving the pulley, secured against traction stress by sprags, which took a lot of uprooting at times. Recently oil engines have been developed for this purpose. The use of such engines would avoid the troubles consequent upon the supply of coal and water, oil being a much more portable fuel; but it is perhaps questionable whether the rural driver is yet mentally up to them, and also whether the small rural engineering shops, accustomed to the rougher steam engine repairs, are equal to the finer work that will be demanded. It must be remembered that the drivers are very largely employed during the winter as repairers of their own engines, and dislocation of this system is going to add to running expense. However the tractor may develop, there will always be a good demand on the heavier lands for these fixed engines to cope with subsoiling, draining, and the heavier forms of ploughing and cultivating. The capacity of cable sets must vary very largely with the soil conditions, &c., a fair average for a 16-ton engine set may be taken as 20 acres a day of 6in. ploughing, using an eight-breast plough. The writer believes that a few larger engines up to about 20 tons in weight are engaged in special farming in Lincolnshire in connection with root crops, but this size cannot be said to be generally popular.

Just before the war, experiments were made in the use of the internal combustion engine arranged as a light tractor dragging a two or three-furrow plough, either on a separate frame behind it, or as an integral part of the tractor. The former type, with very little alteration from the original standard, seems to have caught a limited amount of public favour, but judging from the recent Royal Agricultural Show, the favour is limited to three makes, one each British, Canadian, and German, so it can hardly be claimed that their use is developing at present in agriculture to any great extent; in fact, the greater part of their market would appear to be on the road, judging from the rubber tires seen. There is also a certain amount of prejudice which dies hard in the country, to be lived down, this being caused through the large repair bills of the earlier types, especially when engaged on the heavier lands. In addition to ploughing, at times one may see them engaged pulling reaping machines or driving threshing machines, and one or two small points that seem capable of improvement in connection with these operations will be discussed.

There appears to be an extraordinary number of designs of "ploughs," that is to say, the frame carrying the plough proper, all differing in important characteristics, and it is suggested that a considerable measure of standardisation ought to be applied to the advantage of all parties. Broadly speaking, they all consist of a frame with three wearing parts—coulter, breast, and share. Breasts may necessarily be varied to suit varied soil conditions, but there seems no reason why coulters, shares, frames, and methods of fixing should not be entirely standardised by the manufacturers themselves. The share is subject to the greatest wear, and in dry soils will sometimes barely last out for 2 acres. It is a casting chilled on the upper side, but left soft on the lower, the idea being that the soft side will wear away quicker, and so keep the edge sharp. The writer is not aware that cast steel has ever been used for this purpose, and suggests that it might be interesting to make the experiment, if not already tried.

*Sowing.*—Mechanical sowing is done with a machine known as a "seed drill" requiring a team of two horses for traction, and consisting of a gang of small ploughs making shallow furrows. Behind each plough is a flexible shoot down which the seed is delivered by means of small spoons mounted on a spindle revolving in a receptacle containing the seed. The distance between deliveries can be varied at will to suit different crops. Separate harrows also drawn by two horses are next used for closing the furrows over the deposited seed, and a light flat roller is generally passed over as a final act; in all, three operations with three implements. Some endeavours have been made in the past to combine the sowing and closing up into one action in connection with a cable set. The apparatus consisted of a frame somewhat




PATHS OF TRACTOR, AND HORSE-DRAWN BINDERS

similar to the frame of a cable set cultivator, carrying in the front a set of chisel harrows for lossening the seed bed. Then followed the drill itself, and after that the closing harrow of plain points. The drill was provided with a footboard in the rear for the use of the operator. There seems no reason why this idea should not again be brought into use in connection with tractors, with this further refinement, that behind the drill should be an artificial manure drill, if needed, and after that the closing harrow together with a roller, if required, so that the land would be loosened, sown, manured, the seed covered, and the whole rolled in one action, replacing the labour of seven to eight horses, four men and probably a couple of boys with a tractor, its driver and the drill attendant. Combined seed drills and artificial manure spreaders were to be seen at the Royal Show, so that the combinations mentioned are by no means an untried idea. One can only suppose that their development was arrested through cable traction being too heavy and horse traction too light. These implements vary in width from about 8ft. to 12ft., and as they only apply seed or manure exactly where it is required and in the desired quantity, they are very economical.

*Harvesting.*—The reaping of crops is performed by two arrangements of cutting machines, the cutting principle being the same in each one. The simpler machine merely cuts the crop, so that it falls into fairly narrow swath, its chief use being for grass, &c., crop. The standard width of cut is 4ft. 6in. The larger machine ties up the cut into sheaves and is invariably used for grain crops and beans. The simple cutter is usually double-manned, and requires two teams of a pair of horses to keep it going fully, and under these conditions should cut approximately 12 acres of clover or the like in a day. The binder is also generally double-manned and needs two teams of three horses for continuous work, and should then cut about 14 acres in a day. It might be thought that here was a splendid field for the use of tractors, but, as already mentioned, their minor defects seem to militate against their more general adoption. The first objection is that the binder controls cannot be operated by the tractor driver; hence the combination requires the services of a second man on the binder. The next objection has to do with the corners of a field, and is illustrated by diagrams A and B. Diagram A shows the path of a tractor-drawn binder at a corner of a field, and it will be seen that a piece of cut has to be missed just round each corner. This miss gets more accentuated with each round until what may have been once a right-angled corner has developed into an acute angle. Sometimes when a field is long in proportion to its breadth, it has been found better for a tractor-drawn binder to miss cutting at each end. Diagram B explains the turn made by horses, and shows that at the end of each cut the binder is backed through a quarter-circle, so that it lies straight to the direction of the next cut, and nothing is missed. It may be remarked in parenthesis that this manœuvring takes up quite a little time. The final objection has to do with the binder rather than with the tractor, and it is one of strength; farmers are rather doubtful of subjecting a machine designed for the comfortably slow pace of horses to the almost double speed of the tractor.

We may now consider the modifications advisable in a binder specially designed for work with tractors. First, as the design of the tractor to be discussed will postulate greater power than some of the present designs, the width of cut should be increased from the present standards of 6ft. to 8ft., according to size of machine, to a new standard of 10ft. or even 12ft. Arrangements must be made for short-coupling the binder to the tractor with a single horizontally-hinged bar and for bringing the controls of the former forward so as to be within easy reach of the tractor driver, thus obviating the necessity of the second man. A new method seen at the Royal Show was of driving the machinery of the binder by the tractor engine through a propeller shaft, with universal couplings. This seems an excellent idea, as it is more positive than the usual drive from the main carrying wheel, which sometimes slips over the ground. A possible avenue of defect in the apparatus exhibited was the apparent weakness of the drawbar to withstand the continual horizontal stresses caused by the sharp turning of corners—rigidity here is necessary. The bar also seemed unduly long. If the binder controls are to be handled by the tractor man it will need to be much shorter. In order to avoid ejectment of sheaves at corners, and also to allow of their being dropped in regular lines at right angles to the direction of cut, it is suggested that a light steel-work cradle workable at will from the control position should be fitted just under the delivery in the manner of some of the machines exhibited. The device exhibited will carry about three sheaves, and can be folded up in a sideways direction at will when the sheaves will be dropped off; the idea being that of labour-saving in setting the sheaves up into stooks or shocks, as they are alternatively termed. Corner boys would also be rendered unnecessary. These boys are retained, one to two corners, to throw any sheaves dropped casually at corners out of the way of the manœuvring at the next round.

Coming to simple mowing machines, their standard width of cut of 4ft. 6in. is rather fixed by the width—6ft.—of the standard swath-turning machine used in haymaking, this machine just taking two swaths as cut by the 4ft. 6in. mower. If the cut be extended, it will be impossible to turn the swaths over with the turner, and the cut grass will have to be turned over by "tedding" or throwing up into the air in a casual fashion by an arrangement of revolving forks, known as a "tedder," which may not be considered quite such a satisfactory operation as turning for the following reason:—When the crop has been mowed, the sun dries the top of the cut and also the top of the remaining uncut portion between the swathes. The swath-turner is then used, and in turning the swathes neatly over, turns the dry face of the cut crop to the dry ends standing, leaving the green in each case open to the sun's action. The action of the tedder is merely to scatter the swath at random. Many tractors were exhibited at the Royal Show with mowers in direct combination driven by the tractor engine, but they suffered from too great a length, thus raising the objection discussed above; or, if of standard length, from being too small to justify the entire use of a tractor. In either case the arrangement caused complication, and it is thought that a better arrangement would be to combine two or more 4ft. 6in. machines *en echelon* as a unit for draught by tractors. It is recommended that the cutting "knife" and its attachments, together with the "fingers" through which the knife bar works, should be standardised for all cutting machines, the only difference being in the number of points and length of bar. This would be of material help to the farmers by reducing the number of spare parts necessary. More attention might be given by manufacturers to the reciprocating end of the connecting-rod driving the cutter bar, which is subject to considerable wear, and in a worn state is apt to cause breakage of the bar. What is needed is a quick and cheap method of renewing the bush in the bar and the pin of the rod and some scheme for their continuous lubrication.

*Carting.*—We may now review the vehicles used for cartage about the farm. These consist of "tumbrils"—two-wheeled tipping carts—and four-wheeled wagons, generally used for lighter and bulkier materials. These extraordinary vehicles are springless, and it is probably true that the only alteration of design made in the past three hundred years is the comparatively recent substitution of steel or iron for the "arms"—axle ends. Even to-day one can see a large number fitted with the old wooden arms,

and the accompanying huge wheel nave. Owing to the necessarily large wheel diameter, the floor height of the average tumbril is 3ft. and of the wagon 3ft. 9in., the wheels of the former being usually 4ft. 6in. in diameter and of the latter 4ft. 6in. for the rear and 3ft. 6in. for the leading. The floor height of the wagon is greater than that of the tumbril on account of the clearance needed for the leading wheels when locking. Respective capacities are about 1 to 2 tons for the tumbril and 2 to 3 tons for the wagon. Heavier wagons, but much of the same pattern, for use on public roads, capable of carrying 4 to 5 tons, used to be met with, but they are being replaced by the motor lorry.

Now it cannot be claimed that these vehicles are economical in construction or handling, and it is surely time that some major improvements were considered. The general idea being to evolve a type suitable for working with tractors, it is suggested that the design should be of the "low-loading" type, having four similar wheels about 2ft. 6in. in diameter, mounted on roller bearings, and from 5in. to 6in. on the tread in order to prevent rutting, the tread being slightly cambered to ease the steering. The front wheels should be mounted on stub axles, as in motor lorries, the steering being controlled by the draw bar to allow of easier manœuvring. The capacity should be about 4 or 5 tons, and the wagon should be spring-mounted. As regards tumbrils, they are chiefly useful, outside of small errands, in carting manure from the stock yards to the fields. Wagons are not used here on account of more labour being required in loading—manure being heavy—on to the higher floor, and also because of the difficulty in manœuvring them in the stock yards. But there is no reason why the low-loading wagons outlined above should not be used for this work, seeing that they are free from the disadvantages enumerated. Generally speaking, one low-loader would replace two vehicles—that is, one tumbril and one wagon. The latter might then be abolished altogether, but one or two of the former must always be retained to cope with the many small errands that continually arise about a farm. By far the greater proportion could, however, be dispensed with. The approximate cost to-day of these two vehicles is £43 and £28 respectively, and it would not seem to be beyond the capacity of manufacturers to market a low-loading vehicle on the lines recommended to compete in price with this combined cost.

The usual method of field cartage, whether of manure or of harvest crops, is the three-vehicle system—one loading, one discharging, and one *en route*. The vehicle which is stationary while loading manure or unloading crops keeps one horse idle in the shafts, the reason of this being to avoid the trouble that would be experienced in continually unharnessing and reharnessing. The other two vehicles are generally allowed a shaft horse and a trace horse each. The use of a tractor for the *en route* work would thus replace two travelling and one stationary horse, as the use of horses in the field is considered preferable to the use of a second tractor on account of the continual starting and stopping experienced, whether loading crops or unloading manure, it being only a momentary job to hitch or free the tractor or the trace of a horse team to or from the draw bar of the low loader. A further advantage of the tractor in carting is its greater range through its higher speed. In long hauls between stack and field, it would often save the employment of a fourth wagon and another pair of horses. Low-loading wagons would be quite serviceable for cartage on the public roads between farm and railway or mill. At present this is done sometimes by the farmer's horse teams, but more often by haulage contractors' motor lorries. A good farm tractor ought to be able to move two low-loaders, carrying, say, 10 tons in all over average roads.

*Threshing.*—Threshing machines—known also as "drums"—in most cases are driven and moved about by steam traction engines, many farmers preferring to hire a plant from contractors rather than to be possessed of one. If tractors are satisfactorily to replace steam it would be well if threshing machines, as well as tractors, were provided with alternative driving pulleys of larger diameter, the present size being suitable enough for taking the driving strap from a large diameter, comparatively slow-speed steam engine fly-wheel, but not working too well in conjunction with the high speed and small diameter of the tractor pulley. The steam engine demands the presence of a driver on the footplate to attend to the boiler and to stop the machinery in case of accident; but this man would not be necessary with an internal combustion engined tractor, as a light cord taken from the magneto switch to the rear of the threshing machine would enable the taker-off to stop the entire installation with a single pull in case of accident, and as long as the plant is at work this man must be at his post, as he has to see to the filling of the sacks with the threshed-out grain. A possible improvement in these machines would be a higher grain delivery. At present the sacks in process of filling stand on the ground, and it takes a considerable effort to lift them on to wagons, &c., for removal. This might be done by arranging a light stage a few feet above ground level, and a small elevator in the rear of the machine to raise the grain to the required higher delivery level. The use of low-loading wagons would, however, render this scheme unnecessary. Additional machines for use in connection with threshing machines are chaff cutters for chaffing the straw, elevators for stacking and balers for trussing, and in connection with the entire group the attention of farmers, &c., might profitably be directed towards the advantages of roller bearings as a method by which their money can be saved rather than a scheme for increasing the manufacturing cost.

*Electrical Driving.*—It really seems doubtful whether the cheapest of electrical power is going to be of much use in pure agriculture, as there is so little work of a fixed-point nature. The attaching of an electric motor to a threshing machine has been suggested, and is a possible use, but against it there is the tendency of the farmer to scatter his stacks about the farm, so as to avoid the greater fire hazard of stackyards and to reduce cartage from the field. The use of an electrically driven plant would argue the closing-up of stacking into one or two yards, in each of which would be a plug connection from which current could be obtained. It might, however, be useful to consider electrical current in connection with cream separating and butter churning machinery, and also with the small chopping and kibbling machines used in the preparation of cattle food. It has a further useful possibility in connection with dairy farming in the driving of mechanical milking plant, the use of which has the great advantage of rendering milking free from all human touch. All these machines can be considered as fixtures, and at the moment are often hand driven. There are a lot of small portable and fixed type internal combustion engines on the market competent to drive this class of machinery and they, being well established, will require a lot of dislodging by the electricians. Heavier machines, such as grist mills, are usually reserved for the spare moments of tractors and steam engines, so that electrical driving, although suitable, might not be an economic possibility. There are still a number of the old-fashioned grindstones used for grist milling, as many of the farmers prefer them to the modern crusher with chilled steel rolls, but it would appear that the silk used for the screens in the manufacture of stone-ground flour is no longer obtainable.

*Design of Suitable Tractor.*—The following operations—ploughing, sowing, harvesting, carting, and threshing—have all been discussed, and it has been the writer's endeavour to show that it is possible to use a properly designed internal combustion tractor for all of them, provided that in the instances mentioned the implements are varied or brought up to date, so as to utilise more fully the power output of the engine. One of the greatest disabilities that farmers suffer from is that so much of their plant is only useable for a short period of the year. Anything, therefore, to bring about a more general use of any particular appliance is bound to be of considerable economic help. In this connection, a material point which struck the writer on examining the recent Royal Show exhibits was that there might be with advantage more co-operation among the manufacturers of agricultural appliances in the way that each manufacturer might consider his speciality as a part of a fitted-together whole. For example, the binder must be built to suit the tractor, and the tractor must be evolved in connection with all tractable implements; or, again, standardisation of similar parts should be investigated all with a view of economising effort and expense and speeding-up operation. In design the tractor must not be too heavy, or farmers will say that it will crush the ground too much, in spite of the fact that, considering pressure per square inch, it is perfectly possible for a tractor wheel to be less exacting than a hoof. The steadiest average demand for power is from ploughing, and a tractor capable of driving a drum and a chaff-cutter in combination should pull a two to four-furrow plough, according to land. A good electric or acetylene lighting installation, showing both ways, should always be provided, as there is no reason why tractors should not be extra-manned for continuous work during the night on ploughing or cultivating, it being remembered that a farmer likes the land broken up as soon after the crops are off as possible. If this were done, the capacity of the tractor suggested would be in the range of 10 to 14 acres per twenty-four hours, a slight advance on the single acre of the horse team. Ploughing is always the heaviest operation, as it is all steady collar-work without any easing; consequently a good plough tractor should be equal to anything on a farm.

Harvesting requirements impose a new condition, that of quick and easy steering. Ackermann steering has at last superseded the old plain axle and central pivot, but the steering gear itself seems a little weak and slow. A faster gear, fitted with a much larger wheel with handles for better grip, similar to a ship's steering wheel, is suggested. A necessary refinement seen on Canadian tractors only up to the present is that the locking of the steering gear applies a brake on one driving wheel only, so that the differential is induced to apply its drive to the other wheel in greater proportion, and so assist the turning movement. A latch and notched disc might be usefully fitted to the steering gear, so as to enable the driver temporarily to take his hands off when on a perfectly straight run. The best action at corners when cutting must follow that of horses by reversing through a quarter-circle at the end of a cut in order to lie straight for the next, and so avoid any missing. It is claimed that it is possible if the corners of the field for cutting be slightly radiused by hand in advance to maintain continuity in cutting without any manœuvring at corners by a special rapidity of steerage, but the writer begs leave to doubt whether this radius can be maintained, his experience being that it will disappear after a very few rounds unless maintained by a man with a scythe, which would be a little expensive. Acute-angled corners would give additional trouble, and on the whole it appears that there is no avoiding the backing method explained above. Easier steering in connection with close-coupled implements would be obtainable by placing the steering wheels in the rear of the tractor, which would bring them near to the middle of any combination. Additional fittings should include a comfortable seat in the right place for the driver, a shelter of sorts, and a dust excluder in connection with the carburetter. Failing this latter, the internal economy of the engine will be rapidly ground away by the dust sucked in with the air, especially, for example, in cultivating during dry weather. A further refinement advisable is the provision of two top gears, giving about 3 and 5 miles per hour. Both speeds are required, and it would not be wise to plough on an intermediate gear or to slow up harvesting to the lower speed.

Tractors are now fitted if desired with winches and cable for mole draining or timber hauling, and with proper sprags for maintaining the position of the tractor against the tension of the cable. This is a great advantage on the heavier lands, at all events; but the light land farmer will not be so much interested, hence it must be an extra and not an integral fitting. A final word in respect to tractors is that they must be fitted with a reliable sensitive governor for maintaining even speed on belt work.

The proportion of horses that can be replaced on a farm by tractors is not an easy calculation, and it will hinder mechanisation to claim that it is economically possible to replace all animal traction by mechanical means. Thus, in ploughing it may be possible to replace twenty horses by one tractor, but in carting this may be reduced to three. It is also to be said that less horse strength means less labour in connection with upkeep and fodder and less ground, probably in the range of at least 3 acres per horse, occupied in growing fodder. Horses will always be necessary for special work like that of gang hoeing between growing crops or moving small quantities of food for stock about the farms or similar small errands; but considering the all-round nature of the tractor suggested, it would be reasonable to claim that it ought to replace five horses at a minimum. It will be seen therefore that only the smaller types of farms are unable economically to operate tractors with a complete range of implements, and it is to this aspect of agriculture that the writer desires to draw attention.

## SIXTY YEARS AGO.

After much discussion, an Act was passed by Parliament which required that all trains on British railways that ran for twenty miles or more without stopping should, after April, 1869, be fitted with means whereby the passengers might communicate with the guard or driver. From a note in our issue of July 30th, 1869, it would appear that, although the penalty was £10 for every act of omission, the railway companies, continuing their previous opposition to such means of communication, had failed in numerous cases to meet the requirements of the Act. In one instance a Great Northern train caught fire near Retford. The passengers in the burning coach had great difficulty in attracting the attention of the guard and getting the train stopped in time to save their lives. In another case a correspondent travelling on the Great Western express from London to South Wales heard loud sounds from an adjoining coach soon after the train left Swindon. Looking out of the window of his carriage, he saw three or four people in an adjoining coach endeavouring to attract the guard's attention by shouting and waving their hats and handkerchiefs. They failed to secure the guard's notice and it was not until the next stop at Cirencester Junction that their plight was relieved. It was found that one of the springs of their coach had failed and that for a distance of about 15 miles they had been subjected to a violent and alarming jolting. . . . . Frequent proposals continue to be made for the turning to use of the Sahara by some means or other. From a note in the issue quoted above we learn that Monsieur Ferdinand de Lesseps, the constructor of the Suez Canal, had evolved a scheme whereby the great desert might be converted to serve a useful purpose. Monsieur de Lesseps had sent some engineers to explore the region, and from their observations was convinced that at the point of its nearest approach the Sahara was 27 m. below the level of the Red Sea, and that its depression increased towards the centre. He therefore advanced the suggestion that a canal 75 miles in length should be cut from the Red Sea to the Sahara with the object of flooding the desert and creating a vast artificial ocean which would provide an easy means of intercourse with Central Africa.

The fortunes of the aerial ropeway of the Tilmanstone Colliery Company from their colliery in Kent to Dover, are a matter of public interest. It may be noted, therefore, that the period of two years for the completion of the work, given by the Railway and Canal Commission on July 29th, 1927, has been extended by that court for another twelve months.

## Pulverised Fuel at Sea—The "Swiftpool" Installation.

ON Wednesday last, July 31st, a large party of engineers, shipbuilders and representatives of shipping interests accepted the invitation of the Brand Powdered Fuel System, Ltd., to inspect at West Hartlepool the powdered fuel steamship "P.F.S. Swiftpool," which has been designed and built by Wm. Gray and Co., Ltd., and the Central Marine Engine Works, Ltd., for the service of Sir R. Ropner and Co., Ltd. The new steamer, which was inspected at the engine builder's quay, is of particular interest because she is the first new steamer on Lloyd's British Register specially designed for world trading and entirely dependent on powdered fuel firing.

The principal dimensions of the "Swiftpool" are as follows:—Length between perpendiculars, 421ft.; breadth moulded, 54ft. 0½in.; depth moulded, 30ft. 1in.; and loaded draught, 25ft., with a deadweight carrying capacity of 9100 tons. Her propelling machinery comprises a single-screw installation of triple-expansion engines with three single-ended cylindrical boilers for a working pressure of 180 lb. per square inch. The cylinders are 26½in., 44in. and 73in. by 48in. stroke, while each of the boilers is 15ft. 9½in. internal diameter, with a length of 11ft. 6in. and a total heating surface of 2644ft. It may be noted that the boiler installation was decided upon before the order for the powdered fuel equipment was placed, and the boilers were originally planned for assisted draught, being fitted with 3½in. diameter tubes. These tubes, it is pointed out, are rather large for the forced draught powdered fuel conditions now adopted and for the highest efficiency. Under service conditions it is anticipated that about 2050 I.H.P. will be called for.

The accompanying drawing serves to indicate the principal features of the "Brand" installation. Main bunkers with a capacity of about 2000 tons are arranged in the bridge space on the upper deck, with a hatch approximately over the stokehold of the ship. The coal is trimmed into the daily service bunker from which the pulverisers are fed by gravity. When slack is carried the fuel is passed direct from the main bunkers into the daily service bunker, but when carrying run-of-mine coal the fuel passes through a small Fraser and Chalmers crusher on its way to the daily service bunker. The two pulverisers are arranged port and starboard on the stokehold floor, and they are of the British Rema Manufacturing Company's low-speed roller type. They are driven by a Howden steam engine. A fan for raising the powdered fuel from the pulverisers to the cyclone separators over the ready use bin forms part of the pulverising unit. When leaving the pulveriser the coal is in such a finely divided condition that about 85 per cent. of it will pass through a 200-mesh screen.

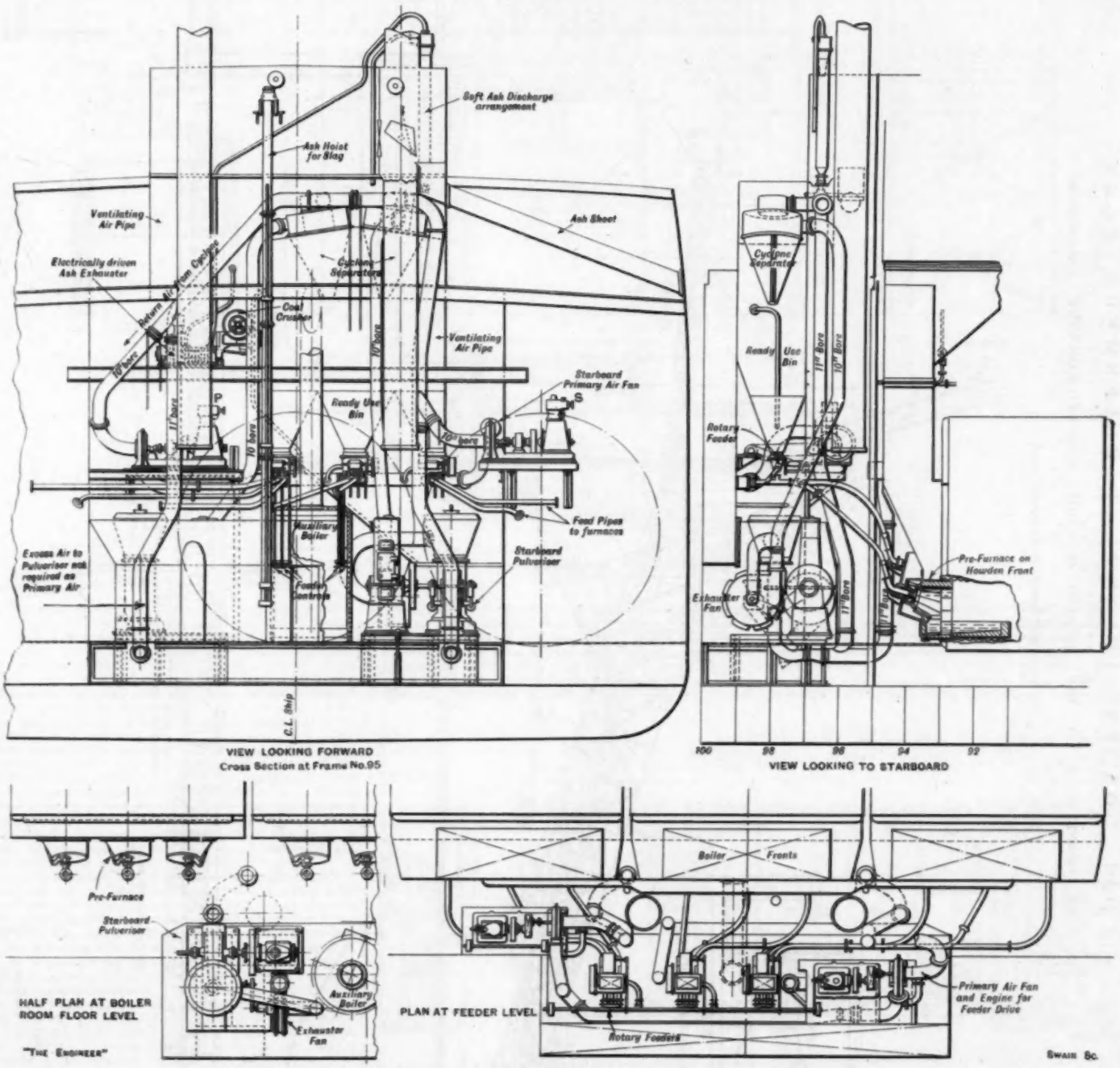
Warm air from the air heaters is introduced into the coal stream as it enters the pulverisers, and this air dries the coal thoroughly during the process of pulverisation and conveys the powder to the ready use bins. In the cyclone separators over the ready use bin the coal dust is precipitated and the clean air released. Part of the air, as shown in the drawing, is returned to the pulveriser and part is employed as primary air.

The ready use bin, which carries a sufficient amount of fuel for steaming for several hours after the pulverisers have been shut down, has been introduced to facilitate the thorough intermixture of the fines and superfines in the coal dust to give ease of feed control to the various furnaces and to provide a reserve supply of fuel.

Below the ready use bin the rotary feeding devices which distribute the fuel in measured quantities to each furnace are arranged. The feeder units are engine driven, and the same engine is employed to work the primary air fans. Again, two units, one starboard and one port, are fitted to provide for independent operation. The feeders are of a patented rotating sleeve pattern working with compressed air and are designed to give a measured feed to each furnace. They are belt driven through P.I.V. variable-speed gears giving a speed variation of from 15 to 90 r.p.m., meeting all conditions from one-sixth to full power boiler load. The primary air is admitted at the feeders and carries the fuel through separate pipes to the respective furnaces. We need hardly refer to the pre-furnaces, which are generally similar to those employed in the recent Barnsley and Stratford tests, which were illustrated in THE ENGINEER for September 21st, 1928, and March 15th of the present year. In the "Swiftpool" installation, however, the pre-furnaces are of welded mild steel and are adapted to conform to the ordinary "Howden" furnace front. The primary air enters the furnace through a central tube and the secondary air is supplied through an adjustable sleeve. There are two doors in the furnace front, one, hinged, to give access to the burners, and the other to permit the withdrawal of the slag and to give access to the main furnace. Hand controls operated from the stokehold floor are provided to enable the supply of fuel to any burner to be cut off if so desired.

In order to remove the light ash an electrically driven ash exhauster is fitted. It permits ash deposited on the bottoms of smoke-boxes to be removed by a vacuum system. Ash hoists are also provided to remove the finely divided slag. In a small vertical boiler sufficient steam is raised to drive the pulverisers and primary air fans should at any time, for example, during survey, all three main boilers be out of action. When in port it is intended to employ one of the main boilers to provide the necessary steam for the winches and deck uses.

The inspection made on Wednesday last was in the nature of a basin trial demonstration, and we hope to publish later full particulars of the official trials. From the accompanying drawing the impression may be gained that the plant is somewhat congested, but a visit to the ship dispels any such idea, as the actual arrangement is such that there is plenty of room on the stokehold floor for plant operation. At the present time complete duplicate machinery is fitted throughout, but it is confidently expected that when in actual service it will be found that some of this machinery is redundant.



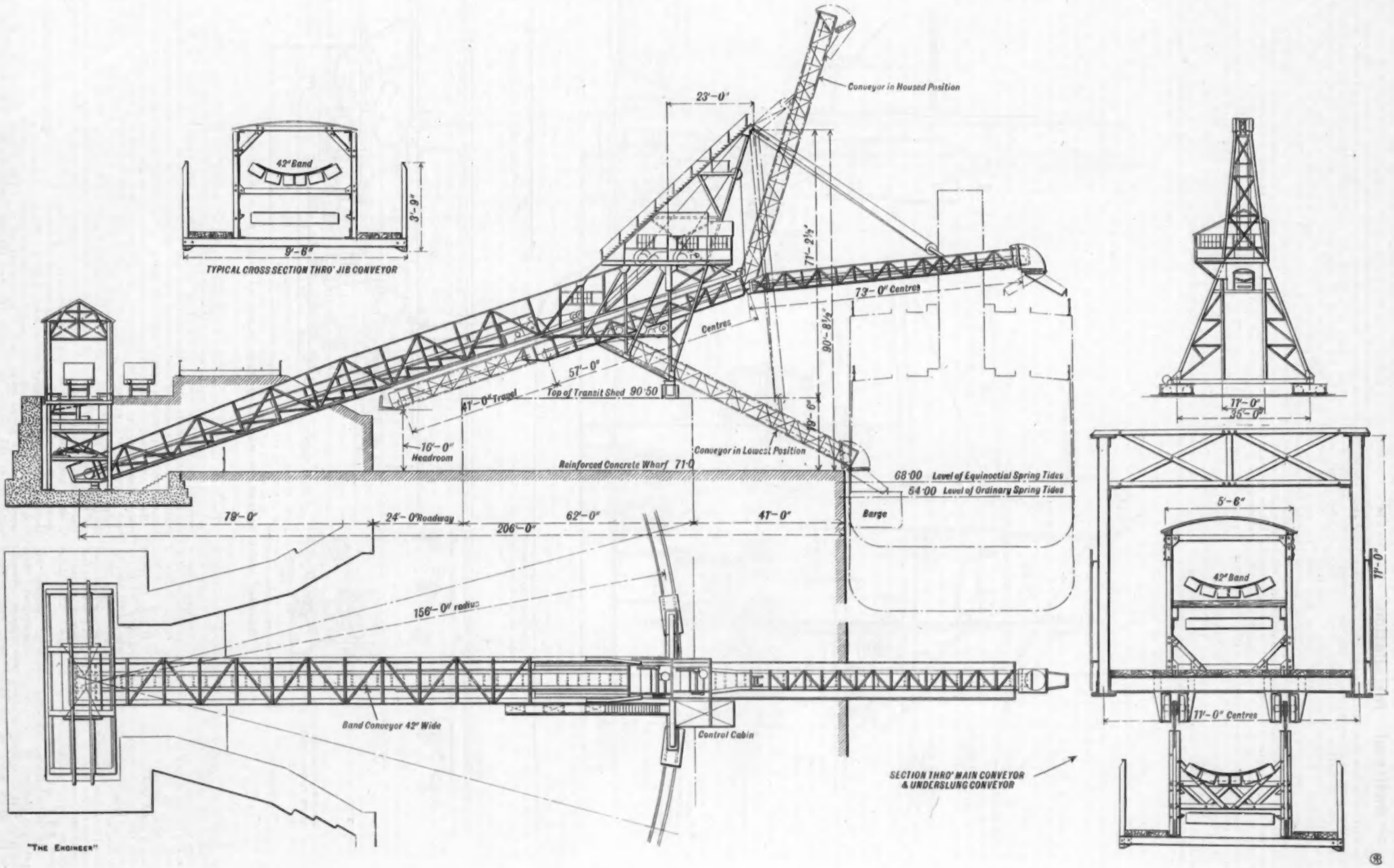

GENERAL ARRANGEMENT OF POWDERED FUEL PLANT IN THE "P.F.S. SWIFTPOOL"

THE Chinese Government is arranging to construct a great new port on the Pacific Coast, about halfway between Shanghai and Hangchow. It is proposed to expend about £5,000,000 on the project and to complete it in sixteen years.

# COAL LOADING PLANT AT ELLESMERE PORT

F. TURNBULL & CO., LTD., HEATON JUNCTION, NEWCASTLE-ON-TYNE, ENGINEERS

(For description see opposite page)



## Mechanical Coal Loading Plant at Ellesmere Port.

ELLESMERE PORT on the Manchester Ship Canal, and only a few miles from the seaward terminus, is making very rapid progress as a port of shipment as well as a manufacturing centre. A glance at a map will show at once its admirable situation for providing North Wales, Cheshire and the Midlands with an outlet for their products. The canal at this point has been dredged to enable ships to load down to 28ft., so that vessels taking in their cargo at Manchester or other places Eastward of Ellesmere Port may take advantage of the increased draught by shipping their bunker coals there, or, if oil driven, they can take up their supplies of liquid fuel at the adjacent oil depôt at Stanlow.

There has recently been erected at this place a very fine coal-loading plant, which forms the first of two double units that will eventually complete the equipment. The plant has been supplied by F. Turnbull and Co., Ltd., of Heaton Junction, Newcastle-on-Tyne, and it embraces several novel features in its design to secure flexibility and mobility. A special advantage which this plant is claimed to possess, is that the breakage of the coal in the course of handling is reduced to a minimum.

As will be observed from the illustrations given herewith and on page 120, the installation comprises a double unit. Each single unit is pivoted at a point 202ft. from the face of the quay, so as to provide a radial movement along the latter. The two sets of conveyors combined are capable of traversing arcs for a length of 260ft. measured at the tips of the loading points, and when the rotary spouts are directed fore and aft, coal can be conveyed to a considerably greater distance. The range of the loading points across the ship and in a vertical direction is shown in the drawings on page 116, from which it will be noted that a liner can be bunkered or a barge loaded with almost equal facility. The maximum capacity of each set of conveyors is between 400 and 450 tons per hour, so that the combined capacity of the two is from 800 to 900 tons per hour, but means have been provided whereby the rate of loading can be reduced to 100 tons per hour each.

Coal is brought in wagons to two fixed tipping hoppers over sidings, which have the requisite gradient for the wagon to run unaided, and is there tipped into the receiving hoppers, each of which is capable of accommodating about 20 tons, by means of hydraulic tippers. One of these tippers is fixed at each end of the hopper, so that it is immaterial at which end of the wagon the door may be situated. End door wagons having a gross weight of 22 tons are principally used, but, of course, with those fitted with doors in the bottom, it is unnecessary to make use of the hydraulic tippers. In order to provide a clear passage the full width of the truck for the coal falling into the hopper and to guard against the possibility of the truck buffers fouling the track girders spanning the hopper, these girders open outwardly so as to leave a gap of approximately 9ft. clear. As soon as the coal is discharged from the wagon, the girders are returned to their normal positions, thus restoring the track. These movements are effected by hydraulic rams working in conjunction with those of the hydraulic tippers, as shown in Figs. 7 and 8. Provision has been made for the fitting of an auxiliary ram which will enable wagons of a gross weight of 30 tons to be dealt with. The hydraulic supply to the tipping ram is at a pressure of 700 lb./750 lb. per square inch.

At the outlet of each hopper there is a regulating door, and from it the coal is delivered on to a jigging feeder shoot which in turn delivers the coal to the first of the two band conveyors. A short stationary plate shoot curved at its lower end is fitted between the jigging shoot and the conveyor in order to project the coal on to the latter in the direction of travel and at approximately the same speed as the conveyor. By these means the abrasive action of the coal on the band which takes place when coal falls directly from a jigging feeder or hopper outlet is reduced to a minimum. The jigging feeder is operated by excentrics through gearing by a variable speed electric motor, and the speed of delivery can be so varied that the coal is fed in a continuous stream according to requirements.

The first conveyor carries the coal a distance of 126ft. up an angle of 18 deg., and delivers it to a second and underslung conveyor, which is provided with what might be described as a telescopic movement, and which can be adjusted to suit the beam of the vessel to be loaded. This telescopic conveyor, at a distance of 57ft. from the inner drum, is further provided with a pivot loading arm, that operation being performed automatically by means of a simply-designed parallel mechanism.

The loading arm is, when not in use, housed back to the nearly vertical position shown on the general arrangement drawing, and so, whilst it allows ample clearance for a ship's rigging, &c., admits of the passage of high pedestal cargo cranes along the quay. Both conveyors in each unit are carried by a bridge structure, the outer end of which can travel along the curved rails laid on the top of the steel buildings which, when completed, will form sheds for the storage of general cargo. For this purpose swivel bogies are provided, one of which is driven through spur gearing by a 35 B.H.P. electric motor fitted with a solenoid brake. Limit switches are placed at each end of the track. The inner ends of the conveyors are pivoted, as already described, underneath the tipping hoppers.

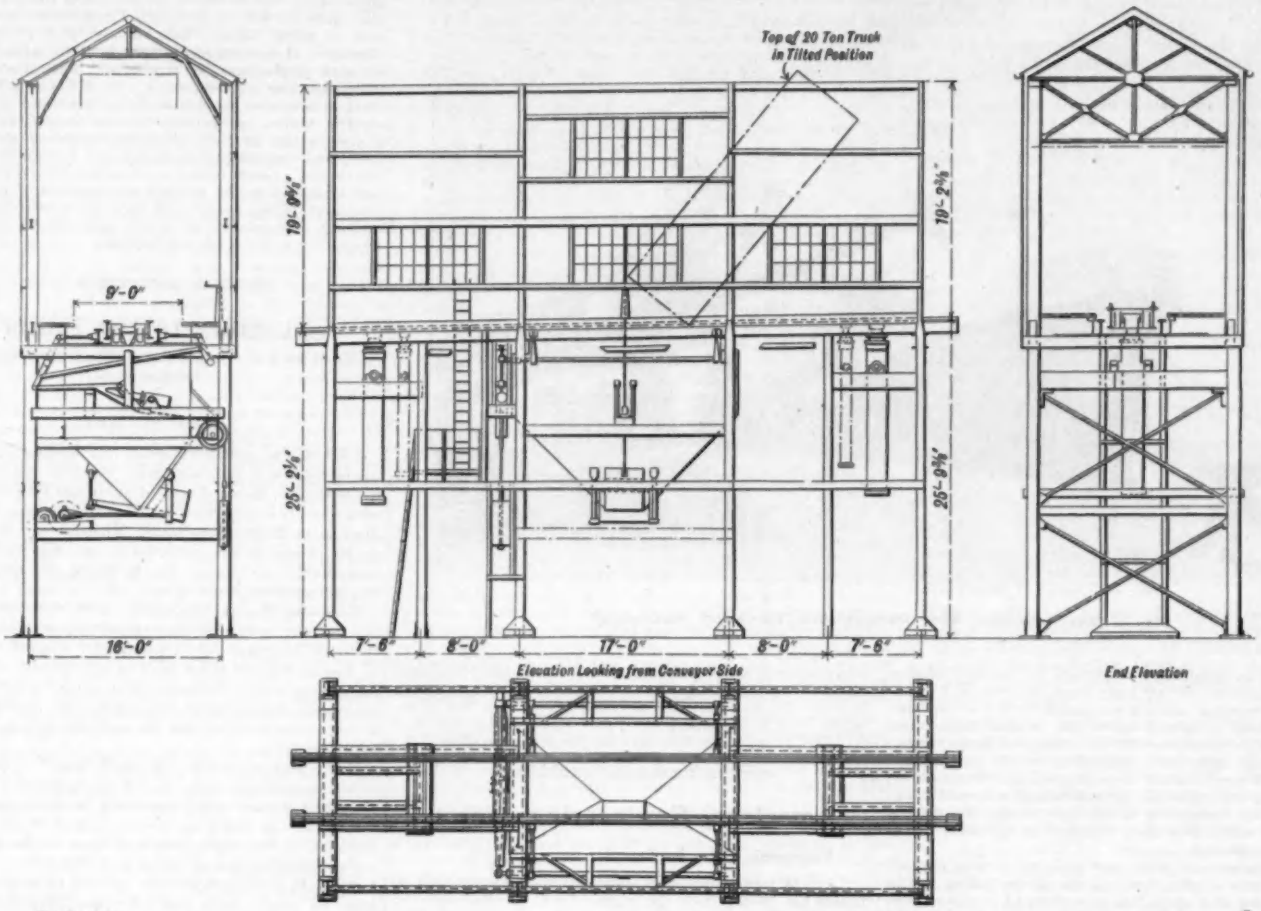



FIG. 1—ARRANGEMENT OF HOPPER AND COAL TIPPING BUILDING

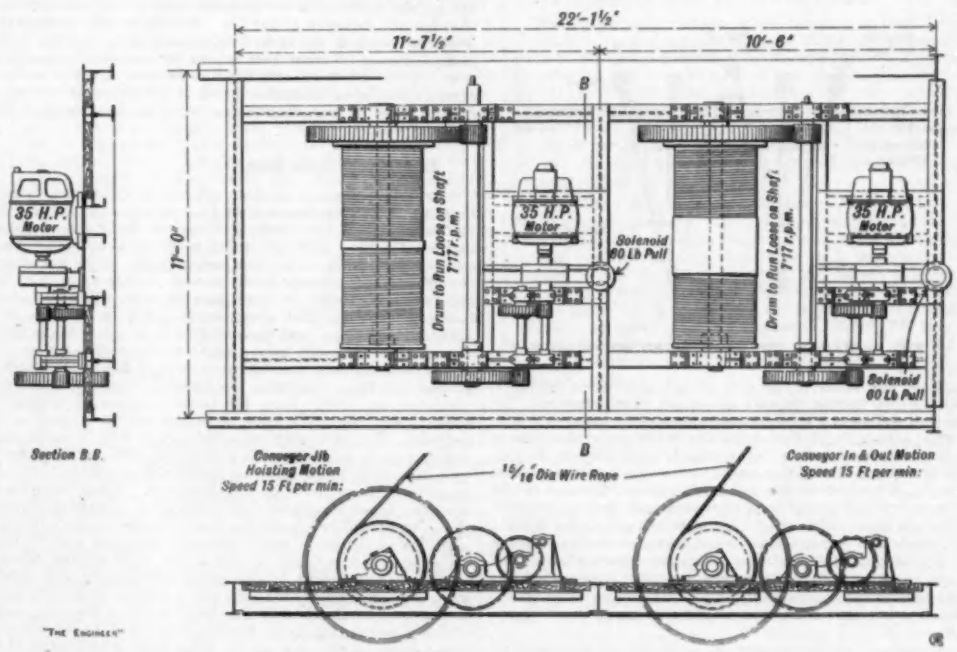



FIG. 2—CONVEYOR OPERATING MACHINERY

The whole of the operations, except those concerned in the tipping of the wagons, are controlled by one man in a control cabin which is placed in a position overlooking loading operations at one side of the hoisting machinery

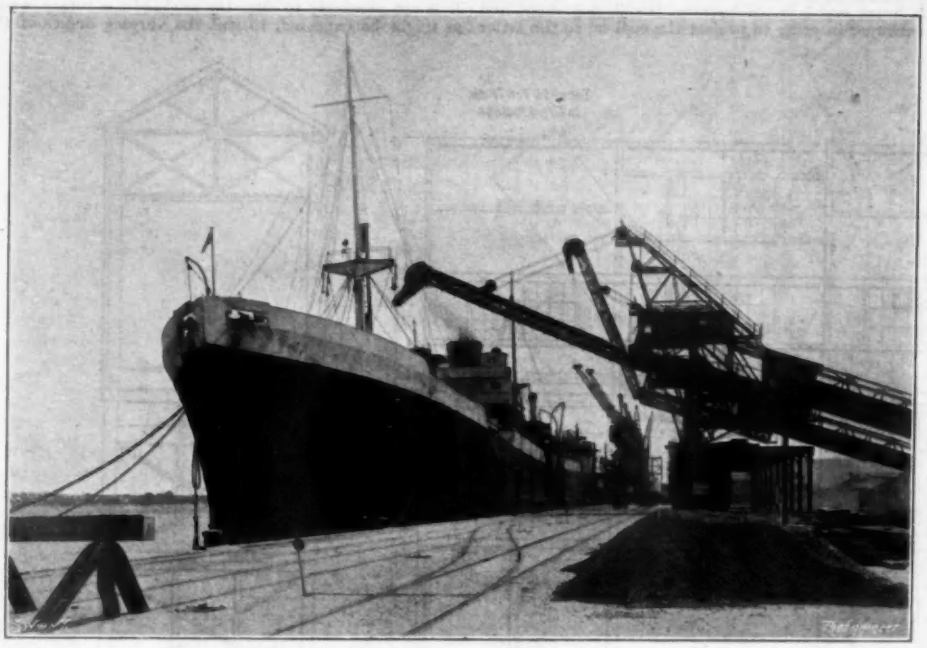


FIG. 3—ONE LOADING ARM DESCENDING TOWARDS HATCHWAY

platform. The machinery is driven by electric motors using direct-current at 500 volts from the company's sub-station, and separate motors are installed for each motion. The main cable is carried up to the control cabin along the bridge from whence current is distributed to the various motors through gear and controllers which are grouped around the driver's stand. For supplying current to the motor driving the telescopic or underslung conveyor which has a relative movement along the bridge structure a looped cable sufficiently long to allow of the 40ft. travel required is employed.

Limit switches are also provided for practically all motions, so that in the event of the driver failing to cut off the current, that operation is performed mechanically, the switches re-setting themselves on reversal of the current.

A diagrammatic sketch plan showing the range of the coal loading spouts is given in Fig. 4.

The conveyors are each 3ft. 6in. wide, the main conveyor being 126ft. 6in. between the centres of the drums, and running at 350ft. per minute, while the telescopic or under-slung conveyor is 130ft. between centres, and runs at 360ft. per minute. They are of the same construction throughout, being of seven-ply best quality cotton fabric with a covering of india-rubber, $\frac{1}{8}$in. thick on the carrying side and $\frac{1}{4}$in. underneath. The carrying side is troughed to a radius of 2ft. 11in. in order to retain the coal without

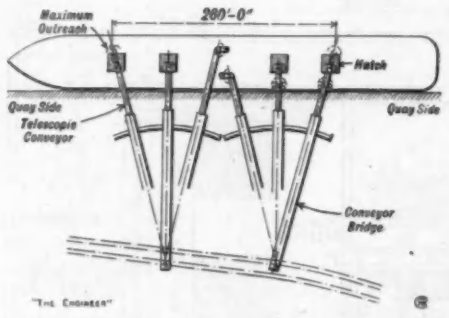



FIG. 4—RANGE OF COAL LOADING SPOUTS

spillage, and is carried on sets of cast iron rollers conforming to this radius, spaced about 3ft. 9in. centres. The bottom rollers are straight and spaced 10ft. apart.

The gearing, Fig. 2, for controlling the in-and-out motion of the telescopic conveyor is arranged, with the winch gear for lifting the end of the conveyor, on the machinery platform and housed in the superstructure at the end of the bridge. These gears comprise cast iron drums together with machine-cut gearing, limit switches and other details. All ropes are reeved over turned cast iron pulleys having a diameter of not less than thirty-five times that of the rope employed. Potentiometer braking is provided for all lowering motions in addition to the usual solenoid brakes which come into operation as soon as the current is cut off.

A system of telephones is used for communication between the operator in the control cabin, the ship and the tippers, while, to facilitate working during darkness or in misty weather, a system of signals by coloured lights arranged on an indicator in the control cabin has been provided. The latter consists of a framed diagram in the cabin with red, green and white lights, which can be switched on and off by means of keys contained in a portable box carried by the signalman stationed on the ship.

All the electric motors were supplied by the Lancashire Dynamo Company, Ltd., of Manchester, and the complete electric wiring system and switchgears by Messrs. Edward Holme and Co., Altrincham. The hydraulic tipping machinery was supplied by Henry Berry and Co., Ltd., Leeds, and the conveyor belts by the Greengates and Irwell Rubber Company, of Manchester. The design of the equipment, as well as that of the quay extension, was prepared under the supervision of the chief engineer to the Manchester Ship Canal Company, Mr. W. A. Reed, M. Inst. C.E., and the chief mechanical engineer, Mr. W. G. Smith, M.I.M.E., A.M.I.E.E., and Messrs. Turnbull and Co., Ltd., were the contractors for the complete plant.

## American Engineering News.

### Volumetric Meter for Liquids.

A NEW volumetric meter for the measurement of liquids has been put on the market by C. M. Anderson, of Salt Lake City. It is claimed to be of simpler construction and greater capacity than any similar device, while it loses less head in operation. Its principal fields are in measuring boiler feed water, condensation and the liquids at industrial plants. It is already in successful use for metering the hot and slimy wastes from a sugar mill. It is applicable also for measuring irrigation water delivered to individual farms, as its low cost and low loss of head make it readily available. The meter consists of a horizontal copper drum or cylinder, divided into pockets and having its lower side immersed in a shallow tank. It is rotated by the power derived from a slight difference in head of water on the inside and outside of the drum, and the partial immersion of the drum reduces the loss of head through the meter to about 5in. For boiler use, the meter is placed between the open feed-water heater and the feed pumps, giving a continuous record by means of a revolution counter on the shaft, and the known capacity of the drum, which is calibrated in terms of cubic feet per revolution. Tests of one such meter showed an accuracy of 98½ per cent.

### The Owyhee Arch Dam.

The largest of the several large dams being built by the Government irrigation service—or Bureau of Reclamation—is the Owyhee Dam on the river of that name in Oregon. It will be 405ft. in height at its maximum section, and 520ft. from the lowest point of its concrete cut-off wall. Its design is of the arch gravity type, with a top radius of 500ft. on the upstream side, the two faces being concentric. The upstream face will be vertical for 75ft. from the top and then sloped 0·05 to 1, while the downstream face will have a uniform slope of 0·626 to 1. Thus the width will increase from 30ft. at the top to 265ft. at the maximum section. A diversion tunnel, 23ft. in diameter and 1000ft. long, will be driven through the rock about 350ft. below the crest level and will be utilised as a spillway. For this purpose a 23ft. shaft will be sunk, its top flaring to a trumpet-shaped intake 60ft. in diameter, with its lip 7ft. below the crest level or at about the desired maximum water level in the reservoir. After construction, the short length of tunnel from its upstream portal to the shaft will be closed and hermetically sealed. Three openings at different levels through the dam will be for the sluices or emptying conduits, the 48in. needle valves regulating the height of the gates surrounding the spillway, and two 6ft. penstocks for a future hydro-electric plant. A 24-mile railway has been built to the site, and a 66,000-volt transmission line has been run. In the design of the dam, 75 per cent. of the water load is carried to the abutments by arch action and 25 per cent. is carried to the base by gravity cantilever action.

### Improved Foundry Management.

Foundries in general have lost considerable business by developments in fabricated steel, stamped steel, and welded work, but most foundries can improve the situation by the use of labour-saving equipment and production methods as a means of lower cost of production and greater output from the same floor space. These views were expressed recently by Mr. Campbell, chief engineer of the Eastern Steel Castings Company, most of the work of which is on orders for quantities of fifty or less. There is such terrific waste of manual effort in the average foundry that the labour cost is about £1 per horse-power hour. But with cheap electric power this might be reduced to 5d., even allowing for machinery cost, repairs, upkeep, and all operating expenses for equipment. Most foundries also have disorderly storage of materials piled on the working floor, thus wasting valuable production space, while if anything at the bottom of the pile is required the whole lot has to be handled and turned over, causing loss of time, labour, and money, and probably some damage. It was suggested that in most cases the present average production on any given floor space could be increased two to three-fold. At Mr. Campbell's plant, sand is delivered mechanically at the moulders' benches, electric trucks carry cores to the ovens, and from the ovens to the moulds. Various moulding machines are used, and the completed moulds are placed directly upon conveyors. Large ladles are handled by overhead cranes and smaller ones by trolleys on runways of rolled joists. The large ladles have brick-lined oil heated covers. The melting is begun in an 8-ton open-hearth furnace and finished in a 6-ton electric furnace.

## Letters to the Editor.

*(We do not hold ourselves responsible for the opinions of our correspondents.)*

### THE ROCKET.

SIR,—I was greatly interested in reading your account of the replica of Stephenson's "Rocket," which has been made for Mr. Henry Ford. I think the English engineers who have the opportunity of seeing this charming reproduction in South Kensington Museum will feel thankful to Mr. Ford for his generosity—not only in having the reproduction produced, but in giving the English public the opportunity of seeing it.

Now that Messrs. Stephenson have succeeded in bringing to light details of this famous engine and embodying them in practical form, surely the English engineering profession will not allow such an opportunity to pass without having a reproduction similar to that which Mr. Ford's generosity has brought into being, for permanent exhibition where his kindness has enabled us to see the engine temporarily.

Forty years after the "Rainhill Trials" I was designing steam engines and boilers, and can appreciate the originality and perseverance necessary to have produced the "Rocket" at the time it was built. Such details, for instance, as the crossheads with their *overhung* cross pins are a masterly piece of design and execution. Even when I was in the workshops there were no twist drills, no split pins, no bright bolts and nuts, and Stephenson's workmanship at that early date is marvellous.

Would you, Mr. Editor, consider a proposal that English engineers should subscribe a fund limited to a small amount in each case, to enable a commission to be placed with Messrs. Robert Stephenson and Co., to produce a second replica for remaining in this country? I feel confident that English engineers would be delighted to have such an opportunity. WILLIAM BOBY.

London, July 29th.

[We cordially support Mr. Boby's suggestion.—ED. THE E.]

### BATTERSEA POWER STATION.

SIR,—The London Power Company, Ltd., have noted with regret the renewed attacks that have recently been made in the Press and elsewhere upon the Battersea Power Station, and this notwithstanding the assurances that have already been given on behalf of the company.

Unfortunately those from whom these attacks emanate have displayed no desire to ascertain the steps taken by the Power Company to fulfil their obligations and to meet the objections to the erection of this station.

The Power Company desire to state in the most emphatic manner that their engineers and chemists have evolved a perfectly practicable and commercial solution of the "sulphur problem," in which they have complete confidence, and that the menace feared will be non-existent so far as the Battersea Station is concerned. Letters Patent have been applied for in connection with the process.

The method and the results have been inspected by the Government chemists, and a full and complete report is about to be issued by the Power Company to the Electricity Commissioners.

W. F. FLADGATE, Chairman.

Horseferry-road, Westminster, S.W. 1, July 26th.

THE South African Railway Administration is strengthening the bridges round about Cape Town with the object of accommodating heavier locomotives. One of the most recently replaced bridges was that over the Eerste River at Faure Station. The new bridge members were prepared in England and assembled alongside the structure to be replaced. The operations included raising the level of the line and making alterations to the foundations so that when the replacement took place both bridges were resting on sleeper cribs. The two structures were lashed together and moved as one. The time taken was, says the *South African Engineer*, forty minutes. The new bridge weighs 75 tons and the old 58. The new structure is of the lattice girder through type and has a span of 105ft. The clearance from rail level to the inside of the girders overhead is 15ft.

## Railway and Road Matters.

THE Railways Enactment, 1912, of the Federated Malay States, whilst requiring returns of railway accidents to be made to the Government, makes no provision for accidents to be inquired into. An amending Bill has now been introduced into the Federal Council which will authorise the General Secretary to order an inquiry, which, further, in serious cases, may be of a judicial character.

AN extraordinary meeting of the proprietors of the Southern Railway was held on Tuesday last, July 30th, to consider the scheme for the transfer of Charing Cross Station to the south side of the river. Opponents of the proposal were very numerous, but, on a show of hands, the motion to approve was declared to be carried. The proxies in favour were, however, 26,500, and only ten against.

ANSWERING a question as to steel sleepers, the Minister of Transport said that the relative cost and durability, as compared with wooden sleepers, depend not only on the variable factor of first cost, but also on such things as the climate, type of ballast, and character of traffic. There are technical difficulties in certain cases, but the attention of the railway companies in this country had been called to the importance of the matter, and they were conducting tests on various sections of their lines.

IN his monthly address to the staff, through the medium of the *Southern Railway Magazine*, Sir Herbert Walker, the general manager, says that he is confident that when the additional routes mentioned in our issue of June 21st have been converted to electric traction, there will be a considerable increase in the traffic. Other plans are under consideration, and the directors are determined to press forward with the electrification of the Southern Railway wherever it appears that the expenditure is likely to produce good results.

ABSORPTIONS of, or amalgamations and working agreements with, road transport bodies by railway companies now occur so frequently as not to merit notice. An exception must, however, be made of the agreement arrived at with the Scottish Motor Traction Company, about which some particulars were made public on July 20th. This transaction is noteworthy in that the road concern controls the largest number of road transport interests in Scotland and because the two railway companies—the London, Midland and Scottish and the London and North-Eastern—are not, in this matter, competitors against each other, but are jointly interested.

THE apparent willingness of the Government to spend vast sums of money on schemes which might find employment is causing the inundation of the Lord Privy Seal with plans, estimates and details of all sorts of ideas, most of which find their way into the department of the Ministry of Transport. It is on the officers there that the labour of providing a suitable reply falls. The possibility of the Channel Tunnel being undertaken has encouraged the revival of schemes for tunnels between Scotland and Ireland and under the Solent. A question as to the former of these two ideas was, on July 9th, addressed to Mr. J. H. Thomas, who said that he would be prepared to consider any scheme which could be shown to be technically and economically practicable, but on the information available he doubted whether the Portpatrick-Donaghadee tunnel fell into that class.

JUDGING by the announcements of the interim dividends, the grouped railways must have had a comparatively good half year. Whilst the London, Midland and Scottish lost £500,000 in receipts, mainly because of the drop in the passenger traffic, economies to the amount of £1,200,000 were effected. Included in the savings was the sum of £540,000 accruing from the 2½ per cent. reduction in salaries, wages, and fees. The London and North-Eastern lost £370,000 in passenger traffic and £198,000 in freight traffic, but the economies effected more than compensated, and the net result for the half year was a net increase of £780,000. Approximately £400,000 of the savings came from the 2½ per cent. reduction. The Great Western lost £200,000 in passenger traffic, but gained £375,000 in freight, and as a sum of £630,000 was saved in expenditure, the end of the half year gave a net increase of over £200,000. The 2½ per cent. reduction produced £230,000. The Southern Railway suffered losses from its steamers and docks, as well as from the railway undertaking, and ended the half year £240,000 down. Economies were made to the amount of £350,000. It may be added that the experience of the London and North-Eastern Railway has probably been that of the three other companies. Though, as said above, it lost £370,000 in passenger traffic, there were 5,000,000 more passengers, and whilst the freight receipts dropped by £198,000, 455,744 more tons were carried.

THE fatal collision of April 23rd at Aller Junction, Newton Abbott, Great Western Railway, was inquired into by Colonel Trench, whose report, just issued, says that it was a serious example of failure of the human element. It appears that a goods train had descended the Dainton bank of 2 miles, at an average of 1 in 50, and had stopped on the up main line at the starting signal to have the wagon brakes lifted. Whilst that was being done a passenger train from off the Torquay branch was offered the signalman, who accepted it, and intended it to proceed towards Newton Abbot. To understand the situation properly it should be said that the up main line from Plymouth becomes the most westerly of the four running lines between Aller Junction and Newton Abbot. The down main line is the third from the west, whilst the second is the up relief, which, actually, is a continuation of the up branch line after that line has crossed the down main line. At that moment there was also offered a passenger train from Plymouth, which the signalman intended to hold back until the branch train had gone forward. Unfortunately, instead of lowering the signals for the branch line, he put those for the main line to "clear," and the passenger train ran into the standing goods, with the result that a servant riding in the brake of the latter was killed. Credit is given to the signalman by Colonel Trench for the frank way with which he admitted his mistake. Whilst the signalman's view of the line up to the starting signal provides for the tail of an ordinary train standing there being seen, light engines or short trains might not be seen, so a track circuit is recommended.

## Notes and Memoranda.

THE natural temperature of the main spring of the Sinclair Radium Hot Springs in Kootenay National Park, British Columbia, is about 114 deg. Fah. The radio-activity in these springs is unusually high, and it is believed that their therapeutic efficacy may be partly due to this fact.

THE standing—central—section of the St. Francis dam in California, the failure of which has already been described in THE ENGINEER, was recently demolished by blasting. The concrete mass was 180ft. high by 90ft. wide by 108ft. thick at the bottom. It required about 5¼ tons of dynamite to shatter the structure.

A NEW method of determining the distance of the sun, suggested at the Dominion Observatory, Ottawa, depends on three accurately known measurements—the velocity of light, the wave lengths of spectrum lines, and the shape of the earth's orbit. Daily observations of the spectrum of the sun's centre with a constant comparison spectrum have been made for years and preliminary measurements indicate promising results.

A NEW boiler is being supplied to the Port Elizabeth (South Africa) power station by Babcock and Wilcox. It will be equipped with a superheater and Green's economiser, together with the necessary stack and additions to coal hoppers and conveying equipment. The boiler unit is of this firm's C.T.M. type, fitted with two compartment type chain grate stokers, and will have a normal evaporative capacity of 50,000 lb. of water per hour, into steam at a pressure of 215 lb. per square inch at a total temperature of 600 deg. Fah. from feed water at 100 deg. Fah., when fired with fuel of a calorific value of 11,000 B.Th.U.

IN an article on "Coke Oven Technology," in the *Fuel Economy Review*, Mr. G. E. Foxwell says that benzol is, after gas, the principal by-product from coke ovens and the most promising for future development. It is, therefore, not surprising that efforts are being made to increase the yield. Apart from the increase due to carbonisation at higher temperatures, which in certain instances leads to yields approaching 4½ gallons per ton, efforts are being made to eliminate sources of loss in the washing process, as, for example, in the acid wash which removes a number of unsaturated hydrocarbons of good calorific value as well as the gum-forming constituents, the elimination of which is the real object of this operation. As these unsaturated hydrocarbons have been shown to be valuable motor fuels, efforts are being made to devise satisfactory recovery or washing processes which will leave these constituents in the benzol. The use of silica gel or active carbon as absorbing media for the extraction of benzol from the gas are alternative methods of achieving this object.

APPROXIMATELY 150,000 tons of metallic manganese is being supplied annually to the steel industry in the form of manganiferous iron ores from the Lake Superior district. The North Central Experiment Station of the United States Bureau of Mines, Department of Commerce, in co-operation with the University of Minnesota, has been developing modifications of blast-furnace and open-hearth practice so as to recover some portion of this large tonnage of metallic manganese in a form suitable for making ferro-manganese, the alloy essential to the steel industry. Electric furnace tests were recently made at the Pittsburgh station of the Bureau of Mines to determine the relative merits of the electric furnace as compared with the open hearth for treating high-phosphorous spiegel so as to produce a high-manganese slag that can be used for making ferro-manganese. These tests indicate that the electric furnace has the advantage of shorter time, more positive control of phosphorus and iron in the slag, more uniform slag lower in silica, and cleaner separation of slag and metal.

THE fifty-third annual report of H.M. Inspectors of Explosives, which has just been issued, includes the accounts of a number of illustrative explosions. Among them there was one, which happened at Auckland, New Zealand, when a store containing some 443,000 gallons of petrol and other combustibles, caught fire, and there were many explosions. The explosions were apparently of two types. In one case the drums burst presumably at the top and the overlaying burnt-out containers were thrown into the air. This was evident from the fact that the containers were in many cases red hot on reaching the ground. In other cases the drums probably burst at the bottom and were propelled like a rocket. The fire brigades threw water into the store and also on to the walls of the building in order to cool them, but the report says: "It is doubtful if the water had any effect on the fire, except possibly to increase the rate of burning due to the additional current of air, and it is also questionable whether the cooling of the outside of the walls would not tend to assist the disintegration of the cement binding." The full report of the Inspectors is published by H.M. Stationery Office, price 1s.

IN the introduction to an essay by several members of the American Bureau of Mines on the precipitation of lead and copper on sponge iron, it is stated that the use of iron as a precipitant for copper is very old, and machines of many types have been employed. Therefore, in contrast to the work on lead, in which the chief interest lay in learning under what conditions and with what mechanisms precipitation could be carried out, the chief interest in the work on copper lay in learning its behaviour on precipitation from various solutions. Afterwards several types of mechanisms in which it would be feasible to carry out the precipitation by sponge iron were noted, and experiments using one apparatus were made. The behaviour of sponge iron made from various ores and by different processes was compared. An excess of 7·5 per cent. of metallic iron over that required stoichiometrically to precipitate the copper was usually sufficient, and little advantage was gained by adding an excess of over 15 per cent. Whether the sponge iron was added in stages or all at the start made little difference. The temperature increased very rapidly as the copper was precipitated and was difficult to control. Often over 80 per cent. of the metal was replaced from solution in two to four minutes, and as the rate of precipitation increased sharply with increase of temperature a carefully standarised procedure was needed to give comparable results.

## Miscellanea.

WORK has been re-started on the asbestos and copper deposits near the Limpopo in the West Nicholson area of Rhodesia.

AN aeroplane factory and aerodrome are to be constructed at Longueuil, near Montreal, Canada, at a cost of 2,000,000 dollars.

A SHOE-MAKING factory is to be put up in Cape Town at a cost of about £30,000. It will give employment to from 400 to 500 hands.

IT is said that the engineers of the South African Consolidated Asbestos Company have evolved a machine which will produce asbestos fibre as good in quality as that got by hand cobbing.

A PLANT for the production of briquetted coal is being put up at the Tilmanstone Colliery, Kent. It is to have a capacity of 1000 tons a week, with provision for an extension to double that amount.

A MOST useful bulletin, No. 285, has just been issued by the United States Bureau of Mines. It is concerned with the ventilation of coal mines and gives a lot of information concerning tests carried out in this connection in America.

THE plant necessary for the extraction of oil and by-products is being erected at the Randulph Colliery of Pease and Partners, Ltd., Darlington. The material which is to be worked upon has hitherto been thrown on the dump.

A TRIAL trip is being made by the American steamer "West Alsek," which is equipped for burning powdered fuel, with her bunkers filled with hard Welsh coal. She is going to the States in ballast with about 500 tons of coal aboard.

A BILL has been promoted in Parliament, and has passed its third reading, for the financial assistance of a scheme which will involve the levelling of 3000 slag and waste heaps in the Midlands, with the object of providing building ground. The work will occupy five years and will give employment to some 2000 men.

THREE crude oil engines of varying power are to be supplied by Ruston and Hornsby in connection with the Bunbury electric light station of Western Australia. The engines will be coupled to direct-current generators. The electrical equipment is to be supplied by the Lancashire Dynamo and Motor Company.

A NOVEL type of steamship specially designed for the conveyance of paper has been ordered from Earle's Shipbuilding and Engineering Company, of Hull, by the Mersey Paper Company, of Montreal. The peculiarity of the vessel will be the arrangement of the deck brackets above the deck, so that the hold space will be quite free. The capacity of the ship is to be 4300 tons of paper.

A SELECTION of the designs received in the competition of Industrial Designs for Prizes and Scholarships offered by the Royal Society of Arts, well-known manufacturers, and other bodies, will be exhibited in the Exhibition Pavilion of the Imperial Institute (East Entrance), South Kensington, London, S.W., from August 3rd to September 1st next, every week-day from 10 a.m. to 5 p.m., Sundays 2.30 to 6 p.m.

CONVEYORS to carry coal from the coal face to the tubs on the main road are to be installed at Hatfield Main Colliery, and it is hoped that, as a result, the output will be doubled in about twelve months' time. Development at Hatfield Main has, says the *Iron and Coal Trades Review*, been very rapid during the last three years, and there is also a scheme for the construction of a light railway to the canal, where wharves will be erected. The output at the moment is about 21,000 tons a week.

THE construction of the Irwin Canal in Mysore is being speeded up, and it is expected that 30,000 acres of land will be brought under irrigation by June, 1931. It is proposed to take up the construction of the masonry work at the Krishnarajasagara Dam, according to the sanctioned estimates and the erection of gates for storing water up to + 124 at the reservoir, so that full supply may be available when irrigation commences under the Irwin Canal. An aggregate sum of Rs. 50 lakhs has accordingly been provided for all these works.

THE No. 1 dry dock of the Barry Graving Dock and Engineering Company, Ltd., is being lengthened by 20ft. in order to accommodate larger vessels. The work is being carried out by Davies, Middleton and Davies, Ltd., of Cardiff, under the supervision of Mr. David E. Roberts, consulting engineer. When completed, the dock will be able to take vessels up to 420ft. in length and the maximum tonnage capacity will be increased to 10,000 tons, as against a maximum of 8500 tons at present. During the work of extension the docking of vessels is proceeded with as usual.

A COMPROMISE regarding the dispute over the sharing of the Cauvery waters between the Mysore Durbar and the Madras Government has been arrived at. The principal term of the compromise is said to be the gauging of discharges for three years, namely, 1917, 1918, and 1919, as was recorded then. This term was formally put before the Durbar, which is reported to have taken its stand originally on the gauging for a period of ten years instead of three. Credit is certainly due to the efforts of the Page Committee which has been inquiring into the causes of the dispute with a view to an equitable settlement.

THE "Discovery," the late Captain Scott's vessel, which has just left the Thames for a new voyage of Antarctic exploration, is equipped with Marconi wireless apparatus that will enable her to maintain constant communication with the outside world. For ordinary ship-to-ship and ship-to-shore communication a Marconi 1½-kW quenched spark transmitter and a ship's receiver of the latest pattern are installed. For special communications from the heart of the Antarctic to Australia and Great Britain a Marconi short-wave telegraph transmitter will be used. In conjunction with this transmitter a new Marconi short-wave receiver is fitted, so that the explorers will be able to listen-in to civilisation. A wireless direction finder also forms part of the navigation equipment of the "Discovery." The Moth aeroplane to be carried by the expedition is also equipped with Marconi apparatus.

# COAL LOADING PLANT AT ELLESMERE PORT, MANCHESTER SHIP CANAL

F. TURNBULL AND CO., LTD., HEATON JUNCTION, NEWCASTLE-ON-TYNE, ENGINEERS

(*For description see page* 117)

FIG. 5—COALING PLANT LOADING INTO BARGE

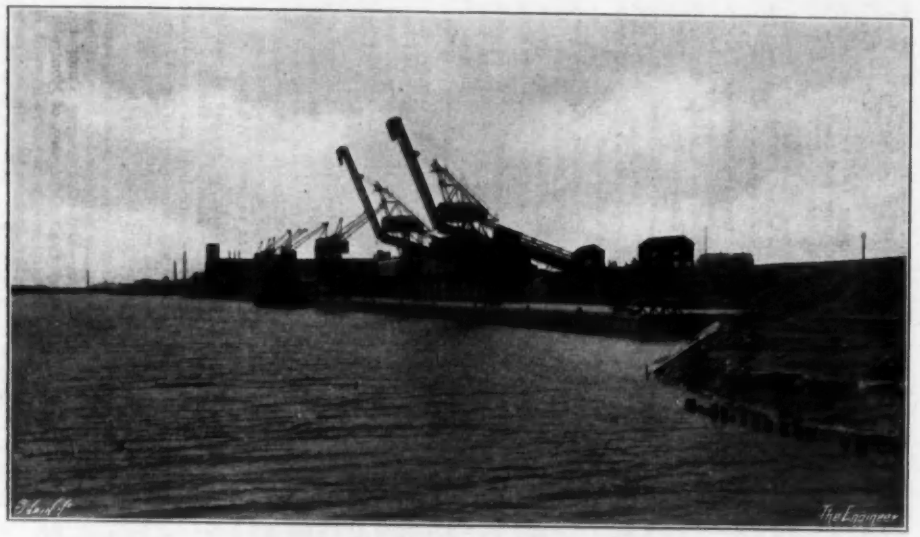


FIG. 6—COALING PLANT HOUSED CLEAR OF QUAY

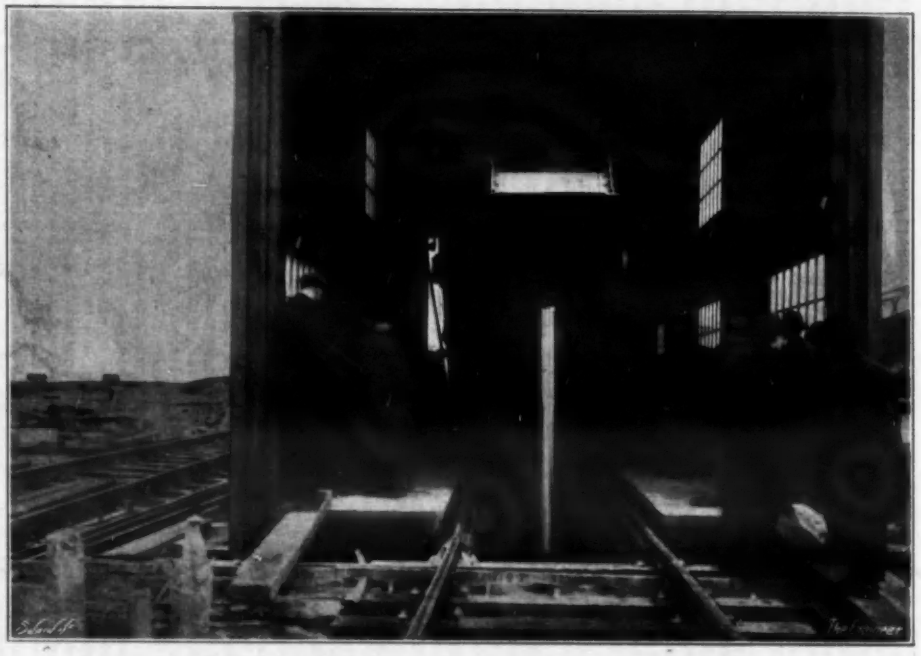


FIG. 7—REAR VIEW OF TILTED TRUCK AND HYDRAULIC RAM

FIG. 8—TRUCK RAISED BY HYDRAULIC TIPPERS AND HOPPER RAILS OPENED

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# THE ENGINEER.

*AUGUST* 2, 1929.

### Twenty Years of Aeronautics.

TWENTY years ago, on July 25th, 1909, Monsieur Louis Blériot startled the inhabitants of these islands by flying across the Channel from Calais to Dover. It is difficult to realise and express the progress which has been made since that historic Sunday morning, in the science and practice of artificial flight. As things go in the history of mechanical invention and development, it is not a lengthy period. It is, for instance, exactly equal to the interval which elapsed between the opening of the Stockton and Darlington Railway and the beginning of the "mania" which, under Hudson's forceful rule, was to break down the opposition of the landed proprietors and give the country a main line railway system much as we know it to-day. There has been no comparable opposition to the development of flying. On the contrary, there has been first the great stimulus to progress exerted by the war, and, secondly, the encouragement, financial and otherwise, actively provided during the post-war years by the Government for the development of aviation as a means of civil transport. No branch of applied science has, by the circumstances of the moment or by the action of responsible authority, been fostered, during the early years of its existence, more liberally than aeronautics. The progress made has been worthy of the opportunity. Yet it remains very difficult to assess. Those who have never known the time when aeroplanes did not exist in large numbers can scarcely avoid under-estimating the trials of the early days and the magnitude of the stout-hearted efforts required to overcome them. Those of us who have followed the unwinding of the chronicle attentively from the first may well feel overwhelmed by the confusion and multiplicity of the detail which a retrospective study reveals. Let us, however, while our minds are freshly charged with the picture of modern aeronautics, disclosed at the International Exhibition at Olympia, attempt to set down an easily appreciated summary of what can be done to-day, and of what was possible no more than twenty years ago.

When Blériot flew the Channel in 1909 it was thought desirable to provide him with a destroyer as escort. It is true that he soon lost sight of it, and that the major portion of his trip, estimated to have covered a total distance of 26 miles, was performed without a guide. That fact to many at the time was one of the most amazing and daring features of the undertaking. Two days later Latham attempted to repeat Blériot's performance, and, profiting by experience, he was provided with an escort consisting of a flotilla of destroyers spread out across the Channel at intervals of about five miles. He fell into the Channel a mile and a half from the English coast, and was rescued. What kind of machine was it on which Blériot performed his pioneering flight? The pen which writes now recorded at the time that it consisted of a light framework formed of ash and poplar, and braced with piano wire. To the forward end of this open framework two curved and inclined planes were attached. The total sustaining area was 17 square yards. In front of the pilot's seat was a three-cylinder Anzani motor, developing 22½ horse-power, and driving direct a two-bladed tractor screw, the form of which clearly showed its descent from the marine propeller. The total weight of the machine, including the pilot and petrol, was about 600 lb., to which the air-cooled motor contributed 132 lb. The trip of 26 miles occupied 35 minutes, and was therefore performed at an average speed of about 45 miles an hour. During it the pilot maintained a height of about 250ft. above the sea . . . . Let us jump all the intervening years, and imagine Monsieur Blériot about to repeat his performance on a modern single-seater machine of the fighter type, as now used by the Royal Air Force. He would find that not a particle of wood was used in the structural framework of the machine. Every stress-bearing member is now of high-tensile steel, electrically hardened after it has been drawn or rolled to the required section, and stove-enamelled to prevent corrosion. Only in the wing covering, which is still of fabric, would he find a correspondence of materials. The machine is a biplane, and its total sustaining area is exactly twice the 17 square yards of his machine of 1909. The engine and screw are still situated in front of the pilot's seat, but the screw is no longer driven direct by the engine, gearing being introduced, with much advantage to the efficiency, which reduces the engine speed of about 2000 revolutions a minute down to about 1300, the same speed as that at which the screw ran in the machine of twenty years ago. The engine, too, is supercharged, in order that it may obtain its full supply of oxygen at the rarefied altitudes to which it is designed to ascend. In place of three cylinders, Monsieur Blériot would now find that his engine has fourteen. It is still air cooled. Its power at sea level is 360 B.H.P., but by virtue of the supercharger it reverses the characteristic of his earlier engine by *increasing* its output as the altitude becomes greater. At 14,500ft. it develops actually 100 B.H.P. more than at ground level. In the weight of the engine he would notice an alteration that would not fail to please him. From about 6 lb. per horse-power the weight has fallen to just over 2 lb., including the weight of the gearing and the supercharger. Having examined the construction of his machine, let us suppose that Monsieur Blériot proceeds to try it in the air. He finds that fully loaded it weighs 3200 lb., or five and a half times as much as his machine of 1909. Of that amount, his own weight and the weight of petrol, oil, and other equipment and stores—including a parachute, oxygen breathing apparatus, wireless gear, and machine guns—represent some 400 lb. Fully loaded, he starts off, and begins to climb. At the end of 3½ minutes he is almost a mile—5000ft.—above the earth. The benefit of his supercharger now becomes noticeable, for his rate of climb does not fall off as he goes higher, but for a while actually increases. The second and third 5000ft. are, in fact, each accomplished in 3 minutes. Thirteen and a quarter minutes from the start he is at 20,000ft., and six minutes later he reaches 25,000ft. He has now risen 4¾ miles above his starting point at an average vertical speed of over 14 miles an hour. Continuing upwards he finds that at 31,000ft. he is still rising more than a hundred feet every minute, and that the ability of his machine to climb is not exhausted until it reaches a height of 32,300ft., or well over 6 miles. He never tested the altitude to which his machine of 1909 could ascend, but he knew that the higher he rose the less would be the speed which he could maintain. Testing his machine of 1929 for speed at different heights, he finds that it is essential to throttle the engine until an altitude of 15,000ft. is reached. At that height he can open it full out with safety, and when he does so he discovers that

he is travelling at 188 miles an hour—four times as fast as his speed at 250ft. twenty years ago. Even at 20,000ft. his speed is only 2½ miles an hour less, and at 25,000ft.—a hundred times the height at which he made his first Channel crossing—it is still over 175 miles an hour, or three times as fast as the average of an express railway train.

It is easier to grasp the improvement which has occurred in the performance of aeroplanes during the past twenty years than the improvements in construction and design which have made the improved performance possible. Something of the constructional developments which have been effected we have indicated in what we have just written. Except for the complete substitution of metal for wood and the abandonment of wing warping in favour of ailerons as a means of maintaining lateral stability, the structural and design improvements of the machine have been entirely in matters of detail. So, too, in the engine, the progress made resides in the cumulative result of many minor advances, except for the fitting of the supercharger. The improvements of detail have been of two kinds—those, such as improved wing sections, which have introduced alterations in the fundamental organs of the machine, and those, such as landing wheel brakes, slotted wings, variable pitch propellers, oxygen breathing apparatus, wireless and direction finding equipment, steerable tail skids, engine starters, and the servo-operation of the control surfaces, which have added something to the fundamental structure. It is, if anywhere, in the multiplicity of these additions that the modern aeroplane is open to the criticism of detached observers. The equipment of instruments is alone sufficient to excite notice. In a three-engined commercial machine the pilot may have as many as seventeen separate instruments or indicators to watch, apart from operating the flying organs and controlling the power plant. In a military machine the instrumental, navigational, and operational equipment has now reached a state of complexity which no one who has not seen it at close quarters will credit. Amazing truly describes the number of fitments and supplies now required to take a pair of 28 lb. bombs into the air and drop them on a selected target. Judged by the standards of to-day, Blériot's flight of twenty years ago, performed as it was with an almost complete absence of everything except a pair of wings and an engine, suffers no loss of daring or merit. If twenty years hence it falls to our lot to present a summary of the progress made in aeronautics since the International Exhibition of 1929, it is very probable that our theme will be less the improvement of performance than the simplification of the means whereby high performance can be achieved.

### Engineering and the Human Values.

THE title which stands at the head of this article is that of an address which Mr. Ralph E. Flanders, manager of the Jones and Lamson Machine Company, Springfield, delivered a few months ago to a group of engineers and students in Knoxville. Mr. Flanders is a man of wide reading and wide sympathies, and he has felt, even in his own country, the *aura*, if it may be so called, of dissatisfaction with the results of engineering development to which we have referred on one or two occasions. "Is human life," he asked, "in any sense deeper and richer for our [engineers'] dominant influence upon it? Can we make contributions to it of our own peculiar kind that will deepen and enrich its future course?" After asserting that such questionings were not natural to the engineering student, he said that it was not so with older men. "For there are many voices in the air—voices of artists, moralists, literary men, social students, philosophers, historians—voices of those whose chief aim is not to do (which is, presumably, our pre-occupation), but to see and to think; and from the confused murmur of this mass of voices there can be detected a general, dominant note of dissatisfaction and accusation levelled at the concrete form into which we, the engineers, have moulded the world." Mr. Flanders then asserted that if such views permeated engineers, no financial rewards would serve to content their spirits, and he set himself to the task of indicating the good, measured in human values, that engineering had done for the world.

He made his case well and eloquently, neither minimising the bad effects of engineering upon our environment nor exaggerating the countervailing good which it had wrought. But one cannot but feel that in many cases the good is primarily only good because it corrects the evil which the engineers themselves have effected. Consider, for example, such matters as the cleansing of the atmosphere or of rivers. If the engineer had not already vitiated the air and the water, the need for purification would not exist. Or to take another striking example from Mr. Flanders, had cement factories never been established, the prevention of the dust nuisance by wet grinding would never have been called for. We submit that this is an important aspect of the problem, one upon which the eye of the engineers of the future must be kept closely fixed. The murmuring to which Mr. Flanders referred will grow in volume, the protests against the obviously objectionable features of engineering will become louder and louder—we hope they will—and the benefits which the works of the engineer confer will be overshadowed by the nuisances that accompany them, unless—unless engineers themselves are the first to recognise the defects and the first and the most eager to remove them. We must not say, "If you want railways and motor cars, you must put up with their noise; if you want steel and coal, you must sacrifice a whole countryside to filth and ugliness; if you want cheap electricity, you must poison with ashes and sulphur the air of your cities." That was the attitude of the past; it will be intolerable in the near future. We must have the products, which the engineer and the engineer alone can give, but they must be so purified from all offence that they can live side by side with less material, but perhaps not less important cravings of civilised people. The "human" must be set against "the money value"—we use Mr. Flanders' terms—and if they cannot be made to balance, then the human must be allowed, even be encouraged, to prevail. The solution of the smoke problem will be greatly delayed, as that advanced American engineer, Mr. George Orrok, has said, "if we wait until somebody finds out how to make smokeless combustion economical in all cases." We must get on with the work, though it cost more, in the firm belief that the æsthetic value is just as true and useful as the monetary value. Mr. Flanders endeavoured to convince young engineers that the effects of engineering are not so bad as they are painted by artists, moralists, literary men, and philosophers. We suggest to him that it is at least of equal importance that the coming engineers should have the defects kept ever before them, and that they should be taught that the greatest aim that they can have is so to discharge all offence from engineering that not the keenest critic can find a word to say against it.

We are convinced that to the engineer all things are possible. He can give us a pure atmosphere and noiseless streets, he can remove slums and make wholesome factories, he can wipe away degrading occupations and improve the occupations of leisure, he can make a fair country out of a blasted waste, and clean rivers out of foul ditches. All these things, and a thousand more, he can do without robbing us of a single one of the benefits and advantages which his works confer. We say this with confidence, because we witness daily all that he has achieved. But a vast amount remains to be done, a mountain of ugliness remains to be removed, and we deem it a good thing that the coming generation of engineers should grow up in the belief that it is the duty of engineers to make the countries in which they live more beautiful and more pleasant and wholly free from the taunts which artists, literary men, and philosophers, may jusify throw at them to-day.

## Literature.

*The Ventilation of Mines: Generation of the Air Current.* By HENRY BRIGGS, O.B.E., D.Sc., Ph.D. London: Methuen and Co., Ltd. Price 7s. 6d. net.

ANY book on mine ventilation necessarily challenges comparison with other recent books on the same subject, and from this point of view it becomes almost imperative to compare this work with the recent works by Professor W. S. Weeks, of the University of California, published in 1926, and by Professor David Penman and Dr. J. S. Penman, published in 1927. Direct comparison is perhaps impossible because the two last-named works aim at a comprehensive presentation of the entire subject, the former more especially as it would appeal to the mining engineer and the latter mainly as it would appeal to the mining student. The book by Professor Briggs, on the contrary, makes no attempt to cover the whole subject, or, to use his own words: "The treatment is selective rather than exhaustive, the author having emphasised those aspects of his subject which especially call for elucidation."

The book originated in a short series of lectures upon Ventilation delivered before the students of the Royal School of Mines in December, 1927. These lectures with some amplifications were published serially in *Colliery Engineering* during 1928, and with but few further additions have now been issued in the present form. As might be expected from a book originating in this way, several portions of the subject which are to be found in most text-books are here but slightly touched upon or even omitted altogether. Thus the description of fans is limited to some six pages, and is confined to only five fans, although it is true that one particular modern form, namely, Mr. Steart's air-screw fan, is described separately, the space devoted to it being rather greater than that allotted to all the other fans put together.

After a brief introduction, the author discusses the laws of the flow of air in mine galleries, and pays special attention to the very important subject of leakage. Practically all the rest of the book is devoted to a discussion of the mine fan and the calculations connected therewith, in which Professor Briggs has naturally made full use of his own numerous and valuable papers on various branches of the subject, as, for example, his well-known work on the fan *evasée*. Incidentally, Professor Briggs discusses at some length the instruments used in the measurement of air pressures and air velocities, and points out, quite correctly, the serious errors to which the ordinary vane anemometer is liable, especially in a pulsating air current. He deals well and at full length with the different forms of Pitot tube, but it is rather curious to find that he pays no attention either to the hot wire anemometer or to the Kata-thermometer. In the same way it is somewhat surprising that as an instrument for measuring small variations in pressure he does not deal with the Paulin aneroid, which appears to be favoured for this class of work, more particularly in America. Professor Briggs devotes some attention to "boosters" of various types, both in the form of auxiliary fans and in the form of blowers of the Venturi type. In discussing these instruments, he would have done well to have availed himself of a number of German papers on this branch of the subject which have appeared in *Glückauf* during the last few months. The whole of latter part of the author's work leads up to a discussion of fan testing, the importance of which the author stresses quite correctly. He has long been known as an advocate of the standardisation of fan-testing methods in this country.

Upon the whole it may fairly be said that although this book does not profess to deal with the whole of the subject of the ventilation of mines, it deals with a number of very important aspects of the subject, and deals with them particularly well, so much so, indeed, as to make this little book one which no serious student of mine ventilation can afford to overlook.

### BOOKS RECEIVED.

*Industrial Furnace Technique.* By A. Hermansen. London: Ernest Benn, Ltd., 154, Fleet-street, E.C. 4. Price 25s. net.

*"Transactions" of the Institution of Civil Engineers of Ireland.* Vol. LIV. Dublin: The Institution of Civil Engineers of Ireland, 35, Dawson-street.

*Annual Report of the Chamber of Shipping of the United Kingdom,* 1928–1929. London: The Chamber of Shipping of the United Kingdom, 28, St. Mary Axe, E.C. 3.

*Annali dei Lavori Pubblici (già Giornale del Genio Civile), Ministero dei Lavori Pubblici, Consiglio Superiore.* 1929. Fasc. No. 5, Maggio. Rome: Provveditorato Generale dello Stato, Libreria. 1929.

*The Workmen's Compensation Acts, 1925 and 1926, with Notes, Rules, Orders and Regulations.* Twenty-sixth edition. By W. Addington Willis, C.B.E., LL.B. London: Butterworth and Co. (Publishers), Ltd., Bell-yard, Temple Bar, W.C. 2. Price 15s. net.

*Surveying as Practised by Civil Engineers and Surveyors.* By John Whitelaw, jun. Eighth edition, revised and enlarged, by Colonel Sir Gordon Risley Hearn, A.M. Inst. C.E. London: Crosby Lockwood and Son, Stationers' Hall-court, E.C. 4. Price 16s. net.

*Experimental Building Science, Vol. II., being an Introduction to Mechanics and its Application in the Design and Erection of Buildings.* By J. Leash Manson and Francis E. Drury. London: The Cambridge University Press, Fetter-lane, E.C. 4. Price 18s. net.

EXPERIMENTAL work for the purpose of determining the viscosity of open-hearth slags and the effect on this property exercised by variations in composition and temperature is being conducted at the Pittsburgh Experiment Station of the United States Bureau of Mines, Department of Commerce, in co-operation with the Carnegie Institute of Technology and the Metallurgical Advisory Board. A certain amount of preliminary work is necessary as a foundation for such a study, and this has been nearly completed with the determination of temperature-viscosity relations in the system $CaO$-$SiO_2$. While the results must still be regarded as being of a tentative nature, certain conclusions may be drawn which are of general interest in steel making. It has been found that when the ratio of lime to silica is about one to one, viscosity is at a maximum. It has also been observed that slags showing this composition—occurring during the early part of a basic open-hearth heat—show a considerable tendency to foaminess. This is due to the combination of a brisk evolution of gas from carbon elimination and a high slag viscosity.

# The International Aeronautical Exhibition at Olympia.

No. III. (*conclusion*).*

WE conclude below our description of some of the principal machines shown at the International Aeronautical Exhibition, which closed at Olympia, London, on Saturday of last week.

THE FORD MOTOR COMPANY.

The great and growing aircraft industry of the United States was represented at the Exhibition by a Ford three-engined all-metal monoplane fitted to carry fourteen passengers and a crew of two. The machine illustrated in Figs. 14 and 15 is "all metal" even to the wing covering. It is of interest not only from the point of view of its design, but because its manufacture is based on the mass production methods which Mr. Ford has made famous in the motor car world. We gather that it is not Mr. Ford's intention at present to build aeroplanes in this country. In America he is now turning out aeroplanes at the rate of one a day.

From Fig. 15, showing the erection of a machine in the maker's factory, some details of the Ford monoplane will be gathered. The wings are of the thick section cantilever type, without external bracing. Beneath them are slung two Pratt and Whitney "Wasp" engines, each of 425 horse-power. A third motor of the same pattern is arranged in the nose of the fuselage. The pilot and engineer sit side by side in an enclosed cabin just behind the central motor, and are provided with a complete dual control equipment. The framework of the fuselage and the wings is composed of duralumin. Corrugated sheets of "Alclad" alloy are employed as a wing covering. The fuselage is covered with "plymetal," consisting of two thicknesses of metal with a layer of lata balsa wood between, a system of clothing which, it is claimed, insulates the cabin against noise and change of temperature. The three engines can be worked at one time, or changed individually. Any two of them, it is stated, will maintain flight at full load. In addition to the cabin with its fourteen seats for the passengers, the fuselage contains a toilet room, a smoking compartment, and a baggage compartment. The landing wheels are spaced over 16ft. apart, and are fitted with a hydraulic shock absorbing equipment and with a brake on each.

The machine has a span of 77ft. 10in., and a length of 49ft. 10in. It weighs empty 7800 lb., and can carry a useful load of 5450 lb. The normal quantity of fuel carried is 277 gallons, and is contained in tanks inside the wings well away from the engine, passengers and crew. The machine has a maximum speed of 135–140 m.p.h., a cruising speed of 115, and a stalling speed of 60 m.p.h. Its normal radius of action is 500 miles.

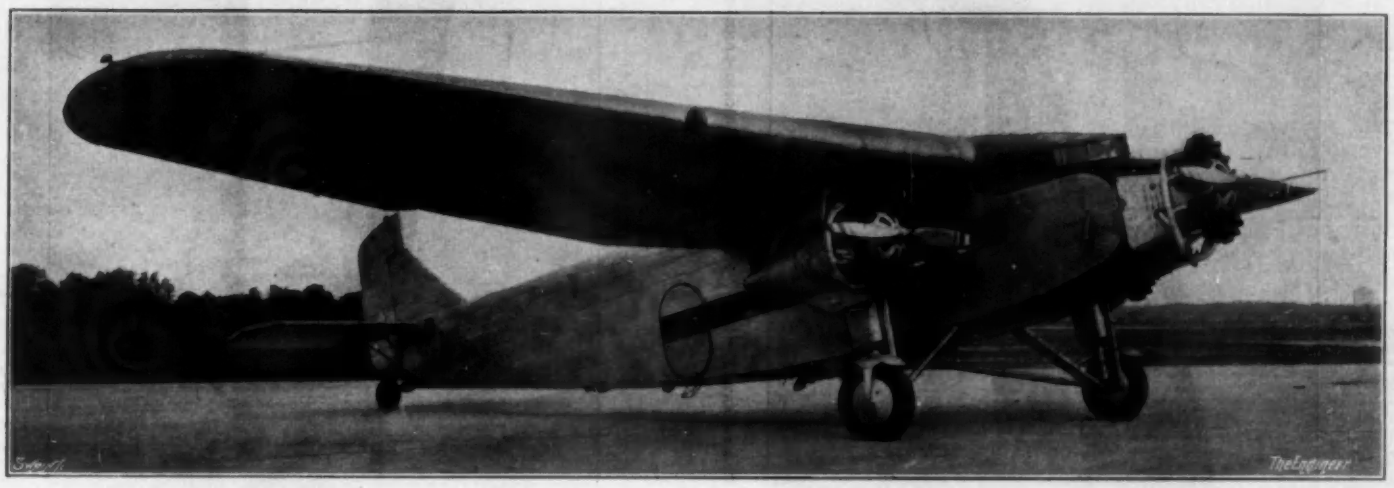


FIG. 14—FORD ALL-METAL 14-PASSENGER MONOPLANE

FIG 15—FORD ALL-METAL MONOPLANE IN COURSE OF ERECTION

* No. II. appeared July 26th.

ARMSTRONG-WHITWORTH AIRCRAFT.

The machines shown by Sir W. G. Armstrong, Whitworth Aircraft, Ltd., of Coventry—excluding those of its allied firm, A. V. Roe and Co., Ltd., which were staged on the same stand—were all of military pattern. It was the company's intention at one time to exhibit the three-engined 20-passenger "Argosy" air liner, but unfortunately that intention could not be fulfilled. The company's exhibits comprised a "Siskin" III. *b* single-seater fighter, an "A.W. 14" single-seater fighter, and an "Atlas" two-seater Army co-operation machine. We have illustrated the "Siskin" and "A.W. 14" on previous occasions. The "Atlas" machine was illustrated in Fig. VIII. in our Supplement a fortnight ago. The "Siskin" and "Atlas" are now standardised R.A.F. machines, and have been built in large numbers by the company and by four other British aircraft firms under licence. The "Atlas" machine carries two guns, a camera, wireless equipment, and message picking-up gear. It can also be used for light bombing, for which purpose it can carry four bombs weighing 112 lb.

All these machines are fitted with Armstrong-Siddeley "Jaguar" air-cooled radial engines which may be plain or supercharged, and be fitted with geared or ungeared airscrews, according to the purpose for which the machine is required. Generally speaking, the performance of any of the machines when fitted with a geared engine is intermediate between its performance when fitted with a plain engine and with a supercharged engine, while the performance reaches its highest mark when the engine is both geared and supercharged. The figures for the "Siskin" may be of some interest in this connection. The total weight of the machine when it is fitted with a plain engine is 3010 lb. The addition of a geared drive to the air screw adds 110 lb. to this weight. A supercharger increases it by 40 lb., and a supercharger plus gearing increases it by 140 lb. to 3150 lb. The respective absolute ceilings are 22,700ft., 24,100ft., 28,400ft., and 31,800ft., and the times to climb to 15,000ft. are 15·5, 13·0, 11·5, and 9·75 minutes. At 15,000ft. the speeds are respectively 144·5, 152, 166·5, and 175 m.p.h. At 20,000ft. the supercharged engine gives the "Siskin" a speed of 154 m.p.h. The addition of gearing to the supercharged engine raises the speed at this height to 174 m.p.h. The times to climb to 20,000ft. are 18·0 and 13·5 minutes respectively. At 25,000ft. the supercharged and geared engine gives the machine a speed of 166·5 m.p.h. The time to climb to this height is 20 minutes. These figures may appear dull to some. Let us therefore say that they show that by the adoption of a geared drive and supercharging, it is now possible to produce a machine which will fly with its full military load 4¾ miles above the earth's surface at a speed two or three times as fast as an express train.

The "Siskin" III. *b* is illustrated in Fig. 16. We reproduce this photograph in order to call attention to the cowling round the engine. This cowling is the Townend ring. It is the invention of Mr. Townend, an assistant in the Aerodynamics Department of the National Physical Laboratory, and has been developed by Armstrong-Whitworth Aircraft to suit the particular needs of the "Jaguar," "Lynx," and "Genet" engines, as a result of experiments carried out in the firm's wind tunnel at Whitley. The Townend ring is a cowl of short chord encircling the cylinder heads and having a camber on the outside similar to that of the upper surface of an aeroplane wing. Its object is to even out the turbulent flow caused by the cylinder heads. Normally, the effect of the turbulence is felt along the whole length of the fuselage, and adds greatly to the natural drag of the body. With the Townend ring in use the turbulence is reduced and the body drag may be lowered by as much as half. In America a form of engine cowling has been devised for the same purpose. This cowling encloses the whole engine except for a small circular space at the front, through which cooling air is admitted. This air is discharged behind the engine at a point between the cowl and the nose of the fuselage. Compared with the American cowl, the Townend ring is claimed to be simpler, lighter, and to interfere far less with the accessibility of the engine.

On the Armstrong-Whitworth stand a striking demonstration was given of the strength of modern all-steel aeroplane construction. A standard built-up high-tensile steel spar for an "Atlas" machine was supported at one end on a trestle, and at the mid-point of its length was attached to a concentrated weight of 500 lb. resting on the ground. At the other end the spar was connected to lifting tackle. This end for the purposes of demonstration was lifted until the weight at the middle left the ground. With the weight hanging free, the spar at the mid-point showed a deflection of about 6in., and was under a calculated stress of 55 tons per square inch. We inspected the spar after it had undergone this test repeatedly during the first week of the Exhibition and could see

# SOME EXHIBITS AT THE INTERNATIONAL AERONAUTICAL EXHIBITION

FIG. 16—"SISKIN III. b" SINGLE-SEATER FIGHTER—ARMSTRONG-WHITWORTH

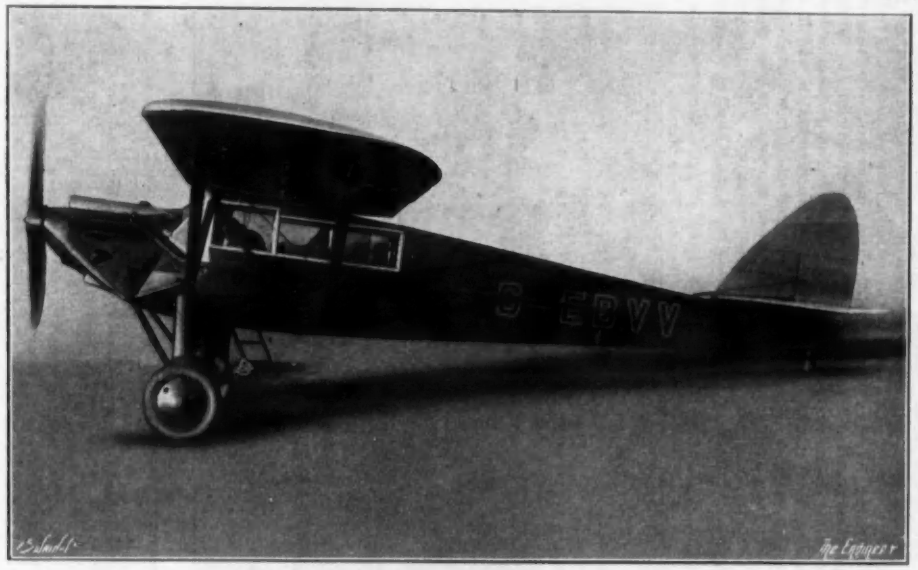


FIG. 17—FOUR-SEATER "LYNX HAWK MOTH" MONOPLANE—DE HAVILLAND

FIG. 18—THREE-SEATER COUPE MONOPLANE—DESOUTTER

FIG. 19—FOUR-PASSENGER TRANSPORT CABIN BIPLANE—BRISTOL

no sign of any permanent deflection in it when the load was released.

Another strength test was of interest from the point of view of the ability of aircraft structural members to withstand fatigue. A standard steel rib for a "Siskin" wing was subjected to a rapidly varying load, ranging from one-half to two and a-half times the normal flying load. The rib had not failed up to the time when we inspected it. In previous tests the rib had undergone, we were informed, many million changes of loading without fracture.

### THE BLACKBURN AEROPLANE COMPANY.

Examples of the "Ripon" and "Lincock" machines and an all-metal "Bluebird" light aeroplane were exhibited by the Blackburn Aeroplane and Motor Company, Ltd., of Brough, Yorkshire. The chief attraction on the company's stand was, however, the hull of the "Nile" merchant flying boat. The hull is an all-metal structure, composed of duralumin, with stainless steel fittings, and is based on the lines of the hull of the firm's "Iris" flying boat, a military machine which has proved very successful. It contains accommodation for fourteen passengers, two pilots and a steward, and was exhibited in the fully furnished state. Internally, the accommodation is strikingly similar to that provided in a railway "Pullman" car. The pilots sit side by side in an enclosed cockpit, which is entered through a door from the passengers' cabin. The passengers gain access to the cabin through a hatchway and accommodation ladders.

In Fig. 20 we reproduce drawings showing the design of the complete machine. It is, it will be seen, a three-engined monoplane. The wings are carried high above the water line to avoid their being damaged by high seas, and the engines are mounted on top of them to obviate interference with their working by spray. The wings are supported above the hull by a faired structure of steel tubes, and by diagonal stream-lined steel struts sloping from the sides of the hull. Two side floats are carried below the diagonal struts, and are set unusually close to the hull. The wing structure is built up of duralumin box spars and duralumin ribs. The tail is also a monoplane structure. It carries three rudders operated by a servo-control, and is equipped with tail trimming gear.

The engines are three Bristol "Jupiters" of 490 H.P. each, or other designs of similar power. They are carried in nacelles faired into the leading edge of the wings. The main petrol tanks are carried in the fairing between the wings and the hull, and from these tanks petrol is distributed to a small service tank in each engine nacelle. There are no fuel tanks, cocks or piping inside the hull.

The leading dimensions of the machine are indicated on the drawing. It will have a total weight of 20,700 lb., and a total load of 5950 lb. The fuel carried will be from 340 to 603 gallons, and the endurance will be from 4½ to 8 hours, according to the load. It is estimated that the top speed at sea level will be 107 knots, the cruising speed 87 knots, and the landing speed 52 knots. From sea level it should be able to climb at a rate of 700ft. per minute. The service ceiling will be in the neighbourhood of 14,000ft.

### DE HAVILLAND AIRCRAFT COMPANY.

Various types of "Moth" machines were exhibited by the de Havilland Aircraft Company, Ltd., of Edgware, but chief interest was, we think, shown in the "Lynx Hawk Moth," which we illustrate in Fig. 17. This machine is a cabin monoplane capable of carrying a pilot and three passengers, and designed for private touring or for commercial passenger and freight carriage, as, for example, on "feeder" lines connecting with main air routes. The fuselage structure is of welded steel throughout. The wings are arranged to fold and are constructed with a framework of spruce. In common with several other machines, which were shown at the Exhibition, the Hawk Moth is fitted with brakes on both wheels. When the machine is alighting the brakes can be operated simultaneously by means of a hand lever. The brake control is also connected to the rudder bar in such a way that, when the machine is "taxying," the brakes are applied separately according to the direction in which the pilot desires to steer the machine. The control of the machine on the ground is further facilitated by the provision of a tail wheel in place of the usual tail skid. This tail wheel is steerable through the rudder control.

Two 35-gallon petrol tanks are carried in the wings, and feed the engine by gravity through a filter, the connection being made by means of "Petroflex" hose. The tanks are mounted on rubber to eliminate vibration, and each is equipped with a gauge which can easily be read from the cabin. The gauge consists of a streamline tube beneath each tank, the petrol level being indicated by a rod operated by a float and lever in the tank.

The cabin is completely enclosed, and is provided with two doors, one for the use of two passengers, who sit side by side towards the rear, and one for the pilot and the third passenger, who sit side by side towards the front of the cabin. The upholstery and fittings of the cabin are quite comparable with those of a modern saloon motor car. Beneath the front seats and behind the rear seats there is room for the accommodation of a considerable quantity of luggage. Writing desks are provided in front of each passenger, and beneath these desks there are lockers or panniers for the storage of small effects. The exhaust pipe is carried well to the rear of the cabin in order to minimise noise and the ingress of fumes into the passengers' quarters. Everything possible has also been done to eliminate vibration. The cushions are air inflated, and elsewhere the upholstery is carried out in a double thickness of leather with a layer of felt between. Ventilation of the cabin is given by means of the sliding side windows. The passengers can also control the heating of the cabin by means of a supply of hot air obtained from a muff on the exhaust pipe.

As shown at Olympia, the machine was fitted with a 240 horse-power geared Armstrong-Siddeley "Lynx" engine. Its normal fully loaded weight is 3500 lb., of which 525 lb. represents the paying load plus the weight of sufficient fuel—70 gallons—for a range of 625 miles. At 1000ft. the machine has a maximum speed of 127 m.p.h., and a stalling speed of 53 m.p.h. Its service ceiling is 15,600ft., and its initial rate of climb is 770ft. per minute. The machine may be loaded to a total weight of 3800 lb. without impairing its structural airworthiness. It can be arranged as a seaplane. So arranged, the normal fully loaded weight remains the same—3500 lb.—but the pay load, plus the weight of 70 gallons of fuel, falls from 525 lb. to 315 lb.

### DESOUTTER AIRCRAFT COMPANY.

The Desoutter Aircraft Company, Ltd., of Croydon Aerodrome, London, is a newcomer to the ranks of British aircraft manufacturers. It has been founded by Mr. Marcel Desoutter, who in the years before the war was a well-known pilot at Hendon, being particularly associated with the Blériot school. Mr. Desoutter has secured the services as works manager of Mr. G. H. Handasyde, who as long ago as 1911 was engaged in the production of aircraft, and who, in conjunction with Mr. Martin, established the Martinsyde firm, which during its lifetime turned out some remarkable machines. The Desoutter Company, therefore, starts its career with connections extending back to the pioneer days of flying. It has made arrangements to produce in this country the light cabin monoplane designed by Mr. Frederick Koolhoven, a Dutch aircraft engineer, who at one time was an active member of the British Aerial Transport Company.

The Desoutter Company's version of Mr. Koolhoven's design was shown at the Exhibition. It is a three-seater coupé monoplane of "all-wood" construction. We illustrate it in Fig. 18. The fuselage is built of spruce longerons and formers, and is covered with plywood. The wing and the tail plane are composed of spruce spars and built up ribs, and in both cases the covering is again of plywood. The tail fin is similarly constructed. The elevators and rudders have a framework of steel tubing and steel ribs, and are covered with fabric. It will be noticed that the wing has no external wire bracing. It is, in effect, of the cantilever type, with three high-tensile steel streamline struts on each side to transmit the landing stresses to the fuselage. A petrol tank to hold 21 gallons is arranged in the centre section of the wing, and is completely insulated from the cabin by the plywood covering on the underside of the wing, and the plywood roof of the cabin and by the air space between these two skins. The feed is by gravity, and all the petrol pipes are arranged outside the fuselage. The engine, a Cirrus III., of 85–95 H.P., is fixed on a mounting of solid drawn steel tubes. It is insulated from the fuselage by a fire-proof bulkhead, which also serves the purpose of preventing oil soaking into the woodwork or leaking into the cabin. When empty the machine weighs 980 lb. Fully loaded, its weight is 1730 lb., and in that condition it has a top speed of 102 m.p.h., and a cruising speed of about 88 m.p.h. Its landing speed is 42 m.p.h., its ceiling 14–15,000ft., and its normal range 400 miles. The machine is intended primarily for passenger carrying. The cabin is completely enclosed, and contains a seat in front for the pilot and a wide seat behind for two passengers. For normal flying its British Certificate of Airworthiness permits it to be loaded to a total weight of 1730 lb. It has also been granted an aerobatic certificate for a total weight of 1430 lb.

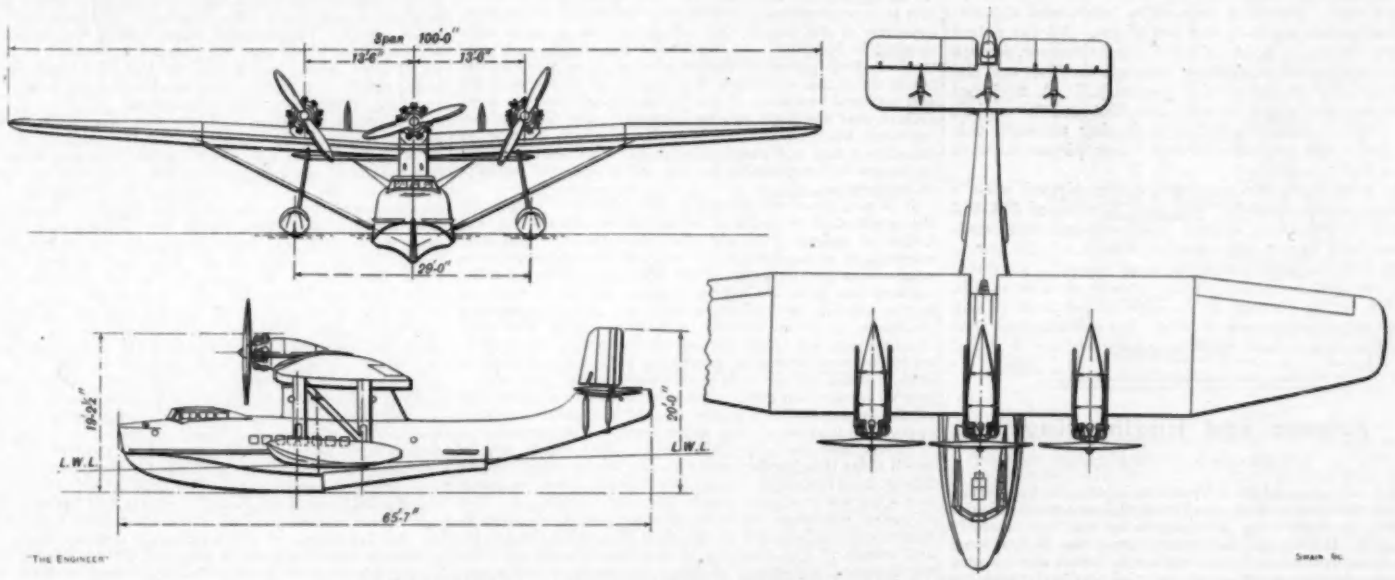



FIG. 20—"NILE" 14-SEATER MONOPLANE FLYING BOAT—BLACKBURN

### THE BRISTOL AEROPLANE COMPANY.

The Bristol "Bulldog" single-seater fighter was illustrated in Fig. III. of the Supplement accompanying our issue of a fortnight ago. We mentioned and illustrated this machine in our issue of January 13th, 1928, but at that time were permitted to say only very little about it. The machine is now in use in the Royal Air Force, and performed well at the Hendon display this year. At the Exhibition close public inspection of the "Bulldog" was permitted, for an example with all or most of its military equipment in position was shown with the coverings partially removed to reveal the internal structure.

The machine, coverings excepted, is built entirely of high-tensile steel, stove enamelled to prevent corrosion. For the present, at any rate, the company prefers to use such steel to material of the stainless type. The enamelling, we are informed, does not add to the weight of any structural part more than 2 or 3 per cent. If the machine is intended to operate at heights up to about 15,000ft., it is fitted with a Bristol "Jupiter" Series VI.A engine. For operation above that height, a "Jupiter" Series VII. supercharged engine is used. The performance of the machine on the supercharged engine is exceptionally good. Fully loaded to 3250 lb., it can climb to 20,000ft. in 13 minutes—that is, to express it in more readily appreciated figures, at over 17 miles an hour—and at that height can fly at 165 m.p.h. Its normal cruising speed is 130 m.p.h. Its maximum diving speed is 270 m.p.h. To demonstrate its structural strength the machine has been dived at over 200

m.p.h., and then put into an inverted loop. Of the fully loaded weight mentioned, 1153 lb. represents the weight of the pilot, military load, 70 gallons of fuel, and 8 gallons of oil. The military load includes two Vickers ¶ guns, 1200 rounds of ammunition, C.C. interrupter gear, gun sights, parachute, oxygen apparatus, electrical equipment, instruments, wireless equipment, signal pistol and fire extinguisher. The guns are placed one on each side of the nose end of the fuselage, and fire through the tractor screw area. They are so placed that the pilot can while in the air obtain ready access to them should they require attention.

As a contrast to this military machine the company exhibited the four-passenger transport cabin biplane illustrated in Fig. 19. Like the "Bulldog," this machine is constructed of high-tensile enamelled steel, the only items of wood being the flooring of the cabin and the framing for the cabin door and windows. The cabin is 6ft. long, 3ft. 6in. high, and 4ft. 6in. in mean height. It is fitted with four seats, and through it the pilot gains access to his enclosed cockpit, situated in front of and beneath the leading edge of the upper wing. The cabin is entered by a door on the right-hand side, and is fitted with windows of "Triplex" glass. Behind the rear seats is a compartment for luggage. The undercarriage is of the "divided axle" type. Both the landing wheels are fitted with brakes, which may be operated separately or simultaneously from pedals fixed on the rudder bar. Without removing his heels from the rudder bar, the pilot can depress these pedals with his toes and thereby apply the brakes. The undercarriage is provided with an oil and rubber shock-absorbing system, which gives an 8in. range of travel. The lubrication of all the working joints in the machine structure is secured by means of a grease gun system, all the nipples being concentrated at the side of the pilot's seat. Petrol is carried in two easily detachable 45-gallon tanks in the top wings. All the petrol supply pipes are made of solid drawn copper, except in the case of the connection between the filter and the carburetter, which is of "petroflex." A fireproof bulkhead is situated between the pilot and the engine. All pipes, control rods, &c., passing through this bulkhead are provided, where they pierce it, with flame tight joints.

As exhibited, the machine was equipped with a seven-cylinder Bristol "Neptune" engine of 295–315 B.H.P. With this engine the machine, it is estimated, will have a top speed at 1000ft. of 125 m.p.h. when fully loaded to 4260 lb. total weight. Its duration at the normal cruising speed of 100 m.p.h. should be 6¼ hours. It is anticipated that it will climb at an initial rate of 600ft. per minute, and that it will be able to land at 56 m.p.h. in still air.

## Science and Engineering.*

By Professor F. C. LEA, D.Sc.

It is not unusual for a President of this Section of the British Association to choose for his address some particular branch of engineering with which he has been actively engaged. During the last twenty-five years I have been closely associated with universities in which the training of young engineers forms one essential part and research a second, although by no means secondary, part of their activity, and it seemed fitting to deal in this address with one or other aspects of that experience. So much has been said and written upon the subject of the type of training that is best for engineers and there are so many diverse opinions of the most suitable course to be adopted for the training of this and that type of engineer that it appeared presumptuous for me to use this opportunity to advance any particular views that I might hold. It seemed in every way better to give attention to the second aspect of university work, to emphasise the importance of the scientific method and research in engineering and in engineering training, illustrating my remarks by reference to several branches of engineering and particularly those with which I have been most closely associated. Further, it seems desirable that the address of a President of a Section shall assist in the primary objects for which the Association exists. Sir William Bragg in his presidential address at Leeds last year pointed out that one of the purposes of the founders of the Association was "to obtain a more general attention for the objects of science," and the first general secretary of the Association nearly one hundred years ago wrote: "The primary purpose of its annual meetings should be the stimulation of interest in science at the various places of meeting and through it the provision of funds for carrying on research." A number of early Presidents of the Association emphasised the place of science in the intellectual life of the people and the beneficent influence of the Association in securing a more general attention to the objects of science, and one of them pointed out the importance to the community of a body of scientific workers "free alike from the embarrassments of poverty or the temptations of wealth." In pressing these claims for public interest in science they had not in mind the applications of science to the material ends which the engineer has in view, and sometimes surprise has been expressed that an Engineering Section should find a place in the meetings of the Association; nevertheless it seems desirable to suggest that, as engineering is so closely related to very many of the activities of modern life and uses for its purposes the discoveries of nearly every branch of science, the aims of the Association are of particular importance in relationship to this section.

The economic and beneficent importance of the work of the engineer is recognised by all, in the provision of safe, reliable, and efficient means of transport and in the wonderful harbours and docks which make possible the interchange of commodities between the nations and incidentally the sharing of your gracious hospitality by so many of us from Great Britain; in the utilisation of sources of energy for doing the work of the world; in the equipment of factories and workshops with machines that produce abundantly so that the standard of life is raised; in supplying to communities pure water and in the disposal of sewage without danger to health or to the contamination of rivers and streams; in making it possible to plough the great spaces and gather the abundant harvests with little labour; in the provision of implements to combat the enemies of the fruit harvest and in the construction of dams and reservoirs to store the abundant rains for the time of drought so that even the barren places shall be fruitful and rejoice. For these achievements of engineering it is not difficult to obtain recognition, but it is often overlooked that engineering is affecting the intellectual outlook of peoples and by its very successes may introduce social and political problems of great significance. The development of the steam engine and the invention of certain types of machines during the eighteenth century changed the industrial life of England, and to-day there are social and political problems, particularly those incident to distribution and concentration of population, that are left as a legacy of the rapid changes in manufacturing conditions and a failure to appreciate at the time the new influences that were moulding the life of the nation. During the last century the work of the engineer has surely had a very marked influence upon the relationships between the nations. Great liners now traverse the broad highways of the seas and iron roads cross continents so that distant peoples are brought near together and the relationships between the nations are irrevocably changing for good or ill. The control of power and mechanical skill have made it possible for the spoken and printed word to disseminate widely thoughts and opinions, so that the worthy and the unworthy have opportunities of influence hitherto impossible. If, therefore, it cannot be claimed that engineering has a direct influence on the intellectual life of peoples and their political relationships, it has an indirect influence, the full significance of which it is at present difficult to evaluate. A clearer recognition, however, of the factors and influences that modern engineering is bringing into the life of the world, and particularly their potentialities for good or ill, as well as their effect upon the incidence of populations and the social and political problems of the future, should not be overlooked, and the hope can be expressed that directly and indirectly the contributions of engineering may be used for beneficent and not destructive ends. Communities, not engineers, are responsible for the use or abuse of the gifts of engineering.

It is not, however, desired in this address to emphasise the intellectual or political influences of engineering, but rather to suggest: (1) the vital importance of scientific research to engineering; (2) that as in the remarkable engineering developments of the last century the scientific method has been the key to progress even so it must be in the future; and (3) that there are many engineering problems of great interest and importance, not only to engineers, but to the general public, which can only be solved by supplementing experience by direct and indirect attack, using all the aids that mathematical and experimental science can give. It is also desired to suggest that all the arguments for a public interest in scientific research apply with particular force to the work of this section.

It has been said, and with truth, that engineering is much older than modern science. In Mesopotamia and in Egypt, long before the dawn of the Christian era, irrigation and other works of great magnitude were carried out. Two thousand years ago the Romans made roads, constructed waterworks and erected bridges that fill us with admiration and wonder. The engineer to-day has to guide him the accumulated experience of many thousands of years and for a solution to many problems with which he is faced he has to fall back upon this accumulated experience and to his intuitive ability. For this reason it is sometimes argued that engineering is an art and that it owes little to science. Recently an important engineering journal wrote:—"The idea that engineering is based upon scientific knowledge is both wrongful and harmful, as it is generally understood. We had bridges before there was a theory of continuous girders and steam engines before there was any theory of thermodynamics." That engineering is an art demanding that creative ability and doing associated with art, as distinct from knowing in the strict scientific sense, is true, and it is also true that there were bridges and prime movers before there was any organised theory of structures or thermodynamics; but it does not appear true to say that there was any possibility of such bridges as the Forth Bridge, the Sydney Harbour Bridge, the Zambesi Bridge, and the Hudson River Bridge of 3500ft. span, now in process of construction, before the birth of modern science and the scientific method. Neither was there a useful steam engine or other great and efficient prime mover before there came into the intellectual life of Europe that wonderful renaissance out of which modern experimental science was born. The Eastern scholars who came to the West after the fall of Constantinople brought amongst their treasures the works of Ptolemaic philosophers, in which were described experiments with heated air and steam, the reciprocating pump, simple water wheels and many ingenious mechanical devices. For 1500 years Roman and Mediæval Europe had neglected experiment, and from Hero to Galileo little or no progress was made in the development of structures, machines, and prime movers. The revival of the experimental method leading to the wonderful conquests of physics and chemistry and in the new attempts to co-ordinate the results of experience into a body of theory, assisted by the new mathematics, gave to engineering that impetus and assistance necessary for the achievement of the last century.

"Meanwhile let no man look for much progress in the sciences, especially in the practical part of them—unless natural philosophy be carried on and applied to particular sciences and particular sciences be carried back to natural philosophy," wrote Francis Bacon in 1620 (Aphorism LXXX., Novum Organum). Twenty-four years after Bacon wrote these words Galileo died and in the same year Isaac Newton was born. From their joint labours, carried out without any desire of practical usefulness, came the principles of mechanics, without which, it is surely not too much to say, much of the progress of the last three centuries would have been impossible. Before Savery and Newcomen produced the first successful steam engine many experiments on the pressure of the atmosphere, the relation between pressure and volume in gases, and the production and the condensation of steam had been made by Porta, de Caus, Torricelli, Papin, Boyle and others; a group of students had gathered together in London, "inquisitive into natural philosophy," and from these gatherings arose the Royal Society; also Galvani had discovered voltaic electricity with all its potentialities for engineering and the world. Seventy years after Savery's first engine was constructed, the greatest step in the development of the steam engine was made by James Watt, not surely as an invention in the ordinary sense, but as a splendid deduction from the quantitative knowledge of the latent heat of steam obtained from the epoch-making experiments of Black and Watt, and the earlier work of Torricelli, Boyle and others on the pressure of the atmosphere; without these prior experiments it seems very doubtful indeed whether Watt's great invention of the independent condenser and the air pump would have been possible.

"The invention all admired and each how he
To be the inventor missed; so easy it seemed
Once found, which yet unfound, most would have thought
Impossible."

But though all may have admired, it was by rather a painfull process that Watt was able to gather the fruits of his achievement. The experience of the pioneer engineer has not infrequently been that of the servants of an Eastern Caliph, who repressed too great popularity amongst his generals by ordering "if the enterprise succeed let the booty be equally divided among my whole army, if its success be doubtful let him lose his head."

A little more than sixty years after Watt built his first steam engine Michael Faraday, supplementing by his unique genius the experimental work of many who preceded him, discovered that a magnet could be made to spin round a fixed wire through which a current of electricity was flowing and a wire containing a current could be made to spin round a fixed magnet. Without these and other equally fundamental experiments the wonderful developments of the generation and transmission of power which have taken place during the last fifty years, as well as the application of electricity to almost every need of the engineer, would have been impossible.

It is true that Carnot and Clausius came after Watt to perfect thermodynamic theory and the modern theories of electricity were not known when Siemens made his first dynamos, but experimental and mathematical science had shown the way to engineering developments of the greatest significance to the life of the world. It has already been noticed that water wheels were known and used to raise water 2000 and more years ago, but in the seventeenth century water wheels were little different from those described by Vitruvius in the first century before Christ and had efficiencies well below 50 per cent. In the latter part of the eighteenth century and the beginning of the nineteenth, organised experiments on the flow of fluids had been carried out, relative velocities, momentum and kinetic energy were well understood, and the next step was made by Poncelet in 1832, who enunciated the guiding principles underlying the design of vanes receiving moving fluids, and from that time progress has been so remarkable that to-day water turbines of more than 70,000 H.P. having efficiencies greater than 80 per cent. are being constructed and millions of horse-power are being generated by water power. The brilliant achievements in the development of the steam turbine of Sir Charles Parsons and others following in his steps are to-day well known. At the beginning of the nineteenth century there were probably 10,000 engines in England giving a total horse-power of about 200,000. To-day steam turbines each capable of developing more than 200,000 H.P., have been or are being made for stations in various parts of the world. It seems very doubtful if this could have been possible except as a consequence of the work of Poncelet and two centuries of scientific experiment. It is fifty years ago this year since the first food-carrying ship was fitted with refrigerating plant; if experiment and thermodynamic theory had not shown the way a commencement would hardly have been conceivable and the developments of refrigeration, which are of such importance in the food supplies of to-day, would hardly have been possible. To many other examples of the direct indebtedness of engineering to science reference might be made. The rapid developments of high-tension distribution of power have been made possible by research in the laboratory. Many attempts had been made to utilise the explosive force of gunpowder, hydrogen, and coal gas for power production before the modern four-cycle internal combustion engine was developed, but without success, until it was recognised from thermodynamical considerations that compression is essential before ignition. The principles of geometrical and dynamical similarity based upon strict mathematical reasoning have been of the greatest service in the development of ships, aeroplanes and airships. In 1862 a committee of the British Association reported that models could not be used to determine the resistance of ships. William Froude, however, disagreed with the committee and enunciated his well-known principles of similarity and showed how the wave-making and frictional resistances could be separated from each other and the total resistance of the ship obtained from experiments on models. Osborne Reynolds and Raleigh extended the argument to fluids having different densities and coefficients of viscosity, and it is thus possible from experiments in one medium to anticipate the resistance and forces acting upon similar models in other fluids. By using Clerk Maxwell's elegant principles of reciprocal displacements the forces and moments acting in statically indeterminate structures can be determined experimentally from models, which cannot be obtained, or only with great difficulty, by mathematical analysis. Sir David Brewster, one of the founders of the British Association, discovered more than a century ago that transparent substances, when subjected to stress, acquire double refractive properties. Taking advantage of this property, Professor Coker, using the precise aids of optics and mathematics, has from models been able to throw much light upon the nature and magnitude of the stresses in structures and machine elements.

*British Association. Section G. Presidential address delivered in Cape Town, August 1st, 1929.

The work of Sorby on the micro sections of rocks has led to microphotography of metals, which has been of the greatest assistance to the metallurgist in the development and control of those metals which have played such a revolutionary part in modern engineering. Unfortunately, sufficient use is not made by engineers of this powerful aid to uniformity of product. In the workshops to-day optical methods are used to make true surfaces, and unskilled men use the electric arc and the diffraction grating spectroscope to check rapidly the analyses of bars of various alloys, confusion in which may lead to disastrous results in engines and machines. Accurate pyrometry and uniform distributions of temperature in heating furnaces are essentials of success in many branches of engineering using alloys of steel and aluminium, cold-worked metals and many other forms of materials. Loss and failure are the serious penalties paid for inaccuracy or inability to use these aids. The judgment of the craftsman and the old "rule-of-thumb" methods, which sufficed until comparatively modern times and which, unfortunately, are sometimes practised to-day, are unreliable and lead to serious lack of uniformity in production and not infrequently to failure where success could have been possible.

Thus it can be said that the important steps that have been made in engineering during the last hundred years and that distinguish this century from all preceding ones were commenced and made possible by fundamental discoveries of science, and it can safely be anticipated that no new epoch-making developments in the future will be possible unless preceded by new fundamental scientific discoveries. Sufficient energy can be transmitted across oceans by directed beams to allow of telephonic communication. It seems improbable that wireless transmission will be possible for the large outputs of power generating stations, but what the future is to reveal cannot be known. In any case the fundamental scientific work of Maxwell, Crookes, Hertz and Fleming was essential before even a start could be made.

At present we depend upon the natural forces of air and water or the energy of controllable chemical reactions in boilers, engines and batteries for our sources of power. Visions of engineers controlling sources of atomic energy immeasurably more powerful than those available at present sometimes come to the hopeful, inspired by the developments of experimental and mathematical physics. Rutherford has shattered the nucleus of the atom. Dr. Krapitza, in the Cavendish Laboratory at Cambridge, has claimed to have reached temperatures of 1,000,000 deg. Cent., and Eddington tells us that in the great power-houses of the sun and the stars, where the temperatures are, it is estimated, as high as 40,000,000 deg. Cent., the energy of the escaping electrons of the atoms is the source which for millions of years has made and will make it possible for the sun and stars to radiate energy without appreciable fall in temperature.

It may be, and until man is more worthy at least it is hoped that it will be, impossible for atomic energy in large quantities to be obtained and controlled. Also it may be equally impossible to obtain energy by the synthetic building up of other elements from the fundamental element hydrogen, which can be obtained in abundance by the electrolysis of sea water, but whatever the future has to unfold it seems certain that only by following the new ways opened by pure science can there be hope of success. Perhaps it may be that not along this path that modern physics seems to suggest will the new knowledge come, but, as many years ago there came the new and wonderful discovery of voltaic electricity while Galvani was making experiments with frogs, so in the future a biologist or chemist or physicist, working on some subject entirely remote from the production of energy, may make discoveries which the Watts and Faradays of the future may use to change the life of the world.

From the point of view, then, of developments in engineering, modern communities cannot afford to neglect the encouragement of scientific research even in those subjects which at present may seem most remote from its activities. Upon almost every section of this association engineering lays tribute and in return engineering has given something at least to make possible much of the brilliant work associated with other sections. The precision of modern engineering made possible the manufacture and control of the great telescopes and other instruments upon the accuracy of which the possibility of testing the attraction, predicted by Einstein, of the light rays of the stars by the sun depends. The latest apparatus by which Michelson repeated the classical experiment associated with his name and that of Morley is a triumph of engineering skill; geology owes much to the data supplied by borings and underground workings, and the work of many other sections has been facilitated by the work of the engineer.

Having, however, recognised the debt of engineering to science for the discovery of new principles and new facts, which have been used as the starting point for new developments, and the dependence of engineering upon pure science for any new and important future developments only part of the story has been told. In his essay on James Watt, Francis Arago wrote in 1834: "There are two things to be considered in every machine; on the one hand the moving power and on the other the arrangement, more or less complicated, of the moving parts," and he might have added—the difficulty of materials suited to the new purpose. He further says that "those persons devoted to speculative exertions are little aware of the distance there is between the project . . . and its realisation . . . the enterprise increases in difficulty and in uncertainty in proportion as it requires the efforts of more artists and the employment of more material elements."

In the workshops, in design, in choosing materials very considerable difficulties have to be overcome before success is possible. The principles of the independent condenser were clearly grasped by Watt, he tells us, as he walked over Glasgow Green, but many years of labour experimenting with materials, many ingenious mechanisms were necessary before the steam engine was at all perfect and in every step that has been taken in the direction of higher pressures and higher temperatures new materials, new processes, and new ingenious devices have been necessary before success could be achieved. Inventive ability allied with experments, research in the development of new metals for tools and machine elements, precise measurement, the perfection of machine shop methods, especially the very extraordinary improvements in machine tools encouraged by the new tool steels and electric driving and control, have all contributed, and wherever success has been sure the methods of science have been followed.

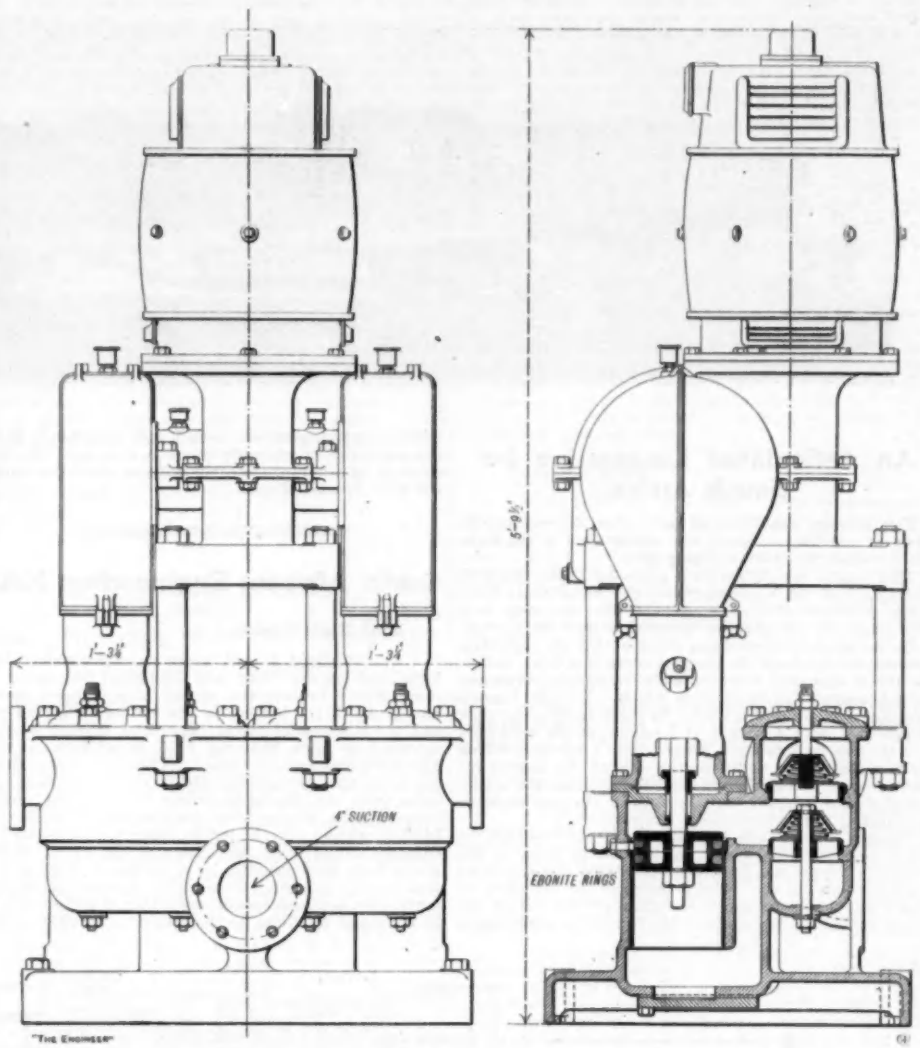
But though so much has been done in the development of prime movers there is perhaps no movement in engineering to-day that is of greater interest, not only to engineers, but to the general community, than the attempts that are being made to considerably increase the efficiency of power production from coal and other fuels. The average overall thermodynamic efficiency of the public stations distributing electrical energy in Great Britain for the year ending March, 1928, was about 15 per cent. The best station had an efficiency of 21·3 per cent. Recently a power unit has been supplied from England to Chicago which on test gave an efficiency of 34 per cent.—a remarkable figure. Making allowance for boiler losses, efficiencies of from 25 to 35 per cent. ought to be possible, therefore, in the future, and if only suitable materials can be developed to meet the onerous conditions of temperature, corrosion and erosion, higher efficiencies than 35 per cent. may be anticipated with steam plant. Still higher thermodynamic efficiencies may be expected, as well as the chemical riches of the coals preserved, if, as a result of research, solid fuel engines or gas turbines can be developed. At the temperature of from 400 deg. Fah. (205 deg. Cent.) to 600 deg. Fah. (315 deg. Cent.) at which boilers and superheaters have until recently worked, mild steels have been found suitable. To realise higher efficiencies than at present much higher temperatures will be required, and at contemplated temperatures of 1000 deg. Fah. (538 deg. Cent.) and upwards carbon steels creep at low stresses. Below a certain stress, at a particular temperature, which I have ventured to call "the limiting creep stress," the creep ceases or becomes so small that it cannot be observed in, say, a number of days. This "limiting creep stress" is evidently the important factor in the problem of high working temperatures. Experiments indicate that with alloy steels limiting creep stresses much higher than those obtained from carbon steels may be expected and that alloys of iron, nickel, chromium and with or without other alloyed elements, containing as much as 60 per cent. of nickel and chromium have considerable strength at high temperatures and also resist corrosion and erosion. There is still, however, a very large amount of research to be done in which the laboratory and the workshop must co-operate, as new workshop technique is required before these alloys can be used for specific purposes.

Research is being undertaken by many manufacturers at great expense and the public finally reap the benefit, but it would appear that in a matter of such vital concern to industry and the community more rapid progress could be made and a much bolder policy pursued if the public organisations and the large power distributing companies and authorities accepted the responsibility of the provision of funds for research. In the universities much fundamental work can be done if funds are available. The Department of Scientific and Industrial Research has recognised recently the importance of the subject and is assisting industry and the National Physical Laboratory to carry out researches on the physical properties of metals at high temperatures. The metal problem, associated with the hope of higher efficiencies in heat engines, is also of very great importance in connection with "low-temperature" carbonisation of coal and other large-scale chemical engineering processes.

*(To be continued.)*

## AN ELECTRICALLY-DRIVEN VERTICAL RECIPROCATING PUMP

A. G. MUMFORD, LTD., COLCHESTER, ENGINEERS




## Electrically-driven Reciprocating Pump.

THE pump which is illustrated by the arrangement drawing given herewith, has been specially designed by A. G. Mumford, Ltd., of Colchester, to occupy very small floor space. The overall height has, at the same time, been kept down, so that the pump is specially useful for operation on shipboard or for other purposes where small floor space and minimum space occupied are essential factors.

The pump is driven by a vertical motor and ball or roller bearings are used for the crank shaft, as well as for the motor and worm gear, so that a high mechanical efficiency is attained. It will be seen that the crank shaft, the connecting rods, and all working parts are completely enclosed, and that no running parts are exposed, but covers arranged for quick detachability allow of access to the connecting rods, and the pump glands are always readily accessible.

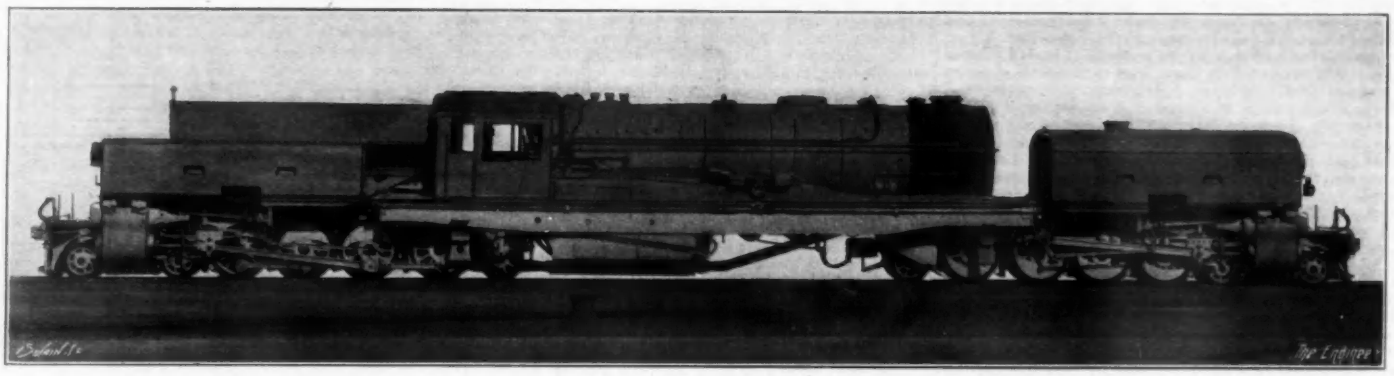
The pumps themselves may be of cast iron or gun-metal, with or without liners, and with valves of different types—all to meet special requirements. They are supplied for low pressure work, such as general service, bilge, ballast, fresh water, oil fuel transfer, lubricating oil, &c., as required on shipboard and elsewhere; and they are also made for high pressure service, such as oil fuel pumps for burners and other services, up to 150 lb. per square inch.

A silent electric motor is normally supplied, but for special yacht work a super-silent motor can be fitted—these, with the special worm gear, making the whole unit practically noiseless. A variable speed motor can be supplied if required, so that the speed may be set to suit the duty. The unit has been given the trade name Vertex.

THE manganese ore which is being mined in the Postmasburg district of South Africa has been proved to contain about 56 per cent. of Mn and about 2·5 per cent. of Fe. The remainder is almost entirely oxygen.

# NATAL STATE RAILWAYS—GARRATT LOCOMOTIVE

BEYER, PEACOCK & CO., LTD., MANCHESTER, ENGINEERS



## An Articulated Locomotive for South Africa.

THE arduous conditions of service on the railways of some of our Dependencies are exemplified in the locomotive which we depict on this page.

This engine, which has been made by Beyer, Peacock and Co., Ltd., of Manchester, for the Natal State Railways, is noteworthy on account of the fact that it is claimed to be the heaviest locomotive built in Europe.

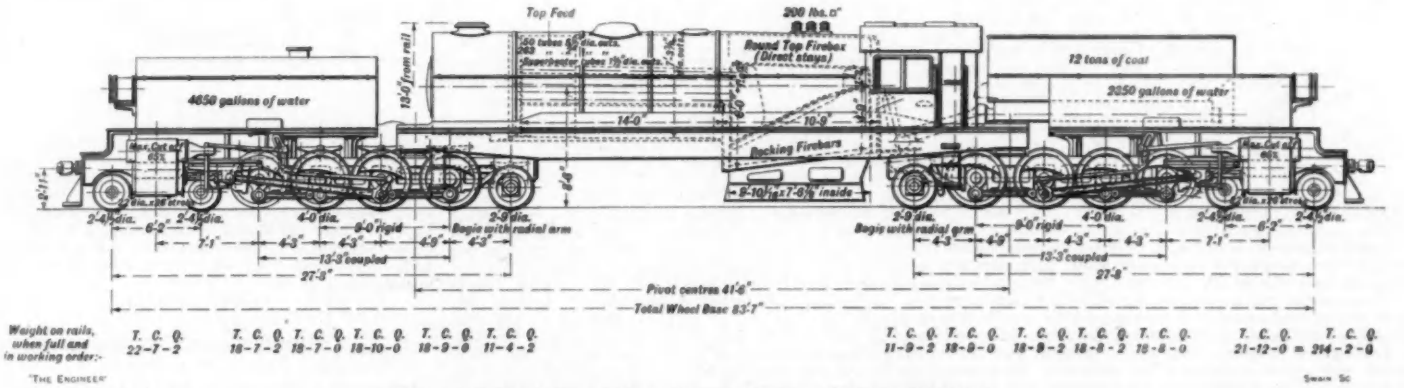
On the recently opened alignment of this line the ruling gradient is 1 in 65 and the sharpest curve is of 700ft. radius, but the re-alignment has resulted in the piercing of several tunnels aggregating 2¼ miles in length. Of these tunnels two are over half a mile long. In these tunnels the crew is provided with a supply of fresh air, which is injected into the cab by a turbine blower, from a reservoir which holds sufficient to ventilate the cab of the engine for half-an-hour. Incidentally, the exhaust from the safety valve, should it open, may be led to the feed tank, so that it does not incommode the driver.

The new engines have been supplied to run on either the old or the new routes and are, as will be seen, of the "Garratt" type, and provide an estimated tractive force, at 75 per cent. of the boiler pressure in the cylinders, of 78,650 lb. The attainment of such a service within the South African railway gauge of 3ft. 6in. will be admitted as an engineering achievement. We may add that the old line between Durban and Gato Bridge includes gradients of 1 in 30, that the curves are uncompensated for radii of 300ft., and that a super-elevation of as much as 4½in. is sometimes necessary.

A noteworthy feature about the engine is the boiler, which is as much as 7ft. 3¾in. in diameter and has a heating surface, including that of the fire-box, of 3376 square feet. It is supported on roller bearings at the sides and a spherical bearing at the front to allow it to accommodate itself to the inequalities of the permanent way.

There are also 809 square feet of superheating surface. The working pressure of the boiler is 200 lb. per square inch. The fire-grate area is 74·5 square feet and the fire is stoked by a mechanical stoker of the "D4" type, which has rocking fire-bars operated by steam, and a drop grate. The stoker itself is worked by a little two-cylinder steam engine. The fire-box is of steel, and so are the smoke tubes, while there are Nicholson thermic syphons and arch tubes to assist in the circulation of the water. Clyde tube cleaners are arranged on the sides of the fire-box and are actuated from the cab. Steam is distributed to the engines through a Beyer Peacock regulator of the double-beat type, in which the two seatings are of equal size, so that a truly balanced effect is obtained. There are two Gresham and Craven injectors.

The engines have cylinders 22in. in diameter by 26in. stroke and the valve gear is arranged to give a maximum cut-off of 65 per cent. The front engine unit is equipped with a steam and a vacuum brake, while the rear unit has a steam and a hand brake. The connecting-rods, it will be seen, drive the third pair of wheels in each case, and they have floating bushes in the big ends. The crossheads are of the Laird type. The cylinders are equipped with Sellars drifting valves for use when the engine is coasting downhill. These valves are operated from the cab. There is a speed recorder on the fireman's side of the cab, and the lubrication arrangements are such that oiling can be carried out conveniently while the engine is running. The water capacity of the tanks is 7000 gallons, while the bunkers will hold 12 tons of coal.




GARRATT LOCOMOTIVE FOR SOUTH AFRICA—WEIGHT DIAGRAM

## South African Engineering Notes.

### Road Motor Services.

ADDITIONAL road motor services continue to be introduced by the Union and Rhodesian Railways. The Road Motor Department opened nine different services during April, the longest of the routes being 124 miles and the shortest 20 miles. The total mileage of service operated at April 30th was 9716, in addition to which 1724 miles had been authorised. These road motor services are doing much to encourage the production of milk, vegetables, fruit, &c., in districts where the economic transport by ox wagons, or even horse wagons, was impossible owing to the expense. In the fertile valley through which the Oliphant River flows the effects of the motor services, which have been running for a couple of years or so, is now plainly evident. Citrus fruit is being grown on a large scale, and this season many tons of the product will be conveyed by motor to the railway. In order to open new routes orders for eight Thornycroft motor vehicles were recently placed. In Rhodesia three new services have recently been started, the longest being from Umtali to Melsetter, the distance being 122 miles. While the Union Administration is ordering Thornycroft vehicles almost exclusively, the Rhodesian Railways prefer the Morris six-wheel lorry, and state that the bad weather months have confirmed the opinion previously formed that the 2-ton Morris six-wheeled lorry is the best type of vehicle for maintaining regularity of service in bad road and weather conditions. Ten new vehicles have recently been placed in service, and the present equipment of the Rhodesian Railways' road motor services comprises thirty-one six-wheeled and three four-wheeled motor vehicles. Thornycrofts, Morris and Leyland motor vehicles are favoured by the private companies that are competing with the railways for goods traffic, though foreign makers, such as International Reds and Whites are also to be seen on the road. Some companies are delivering goods from the ports to places 80 to 100 miles, and even more inland, and doing it considerably more expeditiously than the railways.

### Germiston Wagon Repair Yard.

Great progress is being made with the new wagon repair yard at Germiston, near Johannesburg. While the new workshops are being got ready, temporary workshop buildings, which are equipped with plant and machinery transferred from the Pretoria works, have been erected. The average monthly output of repaired wagons was, in June last, approximately 600, but that number will, of course, be greatly increased when the yard is fully equipped with all plant and facilities it is intended to furnish. The cost of providing shops and yard accommodation is estimated at £345,000, which includes carrying out coach running repairs and general upkeep, including intermediate varnishing. When completed, Germiston will have the largest and most up-to-date wagon-repairing yard in the Union. The area enclosed is 100 acres in extent. A considerable amount of levelling and reclamation has been necessary. Approximately ten miles of platelaying with seventy sets of points and crossings have been carried out. At present the work of the yard is mostly confined to the repairing of steel wagons, but it is the intention that at some future date all classes of repairs shall be undertaken at Germiston.

### Railway Traffic.

During the financial year ended March 31st, 1929, passengers to the number of 67,966,456 travelled on the Suburban lines of the Union, compared with 68,117,674 during the previous financial year. On the main lines and suburban sections of the Union and South-West Africa, 81,994,517 passengers travelled during the year ended at the same date. This figure, which has not previously been exceeded, represents an increase of 339,647 over the number of passengers carried in 1927–28, in which the previous highest number was recorded. Revenue-earning goods and mineral traffic, other than coal, conveyed during March, 1929, totalled 841,170 tons, compared with 882,507 tons in the corresponding month of the previous year. Altogether, 12,344,078 tons of revenue-earning goods and mineral traffic, other than coal, were conveyed during the financial year ended March 31st, 1929. This total tonnage constitutes a record, and exceeds by 791,853 tons the tonnage in the financial year ended March 31st, 1928, during which the previous record was established. The biggest increases were in sugar cane, increase 158,550 tons; flour, meal, and bran, 142,027 tons; manures and fertilisers, 51,223 tons; and sugar, increase 40,407 tons. Bricks and building stone carried decreased from 537,489 tons to 414,488 tons, or by 123,001 tons. Over 12,000,000 tons of coal were carried to Durban and other ports for shipment and to various industrial centres and for use on railways.

### Volume of Cargo Landed.

The volume of cargo landed and shipped during the first quarter of 1929 at Union ports was 2,050,264 tons, compared with 1,991,186 tons in the first quarter of 1928. The increase would have been much greater but for the fact that the 1928 maize crop was nearly all shipped in that year, whereas much of the 1927 maize crop was held back and only exported in the first quarter of 1928. There has been a big recovery in the quantity of coal bunkered and coal shipped. In the quarter ended March 31st, 1929, 416,447 tons of coal were exported, compared with 300,021 tons in the corresponding quarter of 1928, or an increase of 116,426 tons; 361,896 tons of coal were bunkered in March quarter of this year, compared with 338,402 tons in 1928. Railway material imported in the March quarter was 99,495 tons, compared with 58,060 tons in 1928, an increase of 41,435 tons.

### Communications in Uganda.

The Colonial Office, so it is reported from Nairobi, has approved of the expenditure of £268,000 from Uganda's £1,250,000 surplus balances on an important communications scheme which is calculated to lead to a more rapid

development of distant parts of Uganda. The scheme includes the construction of main roads in the Ankole Province, which is the south-western part of the Protectorate, and also the establishment of a port 90 miles inland from the mouth of the Kagera River, which runs parallel with the boundary of Tanganyika and Uganda. The road scheme, plus the opening of the Kagera River for navigation, will serve a large area in Uganda, Tanganyika, and the Belgian Mandated Territory, the traffic from which has hitherto been carried for long distances by road. The Belgian authorities cordially support the scheme, which indirectly will assist in the more intensive development of Ruanda.

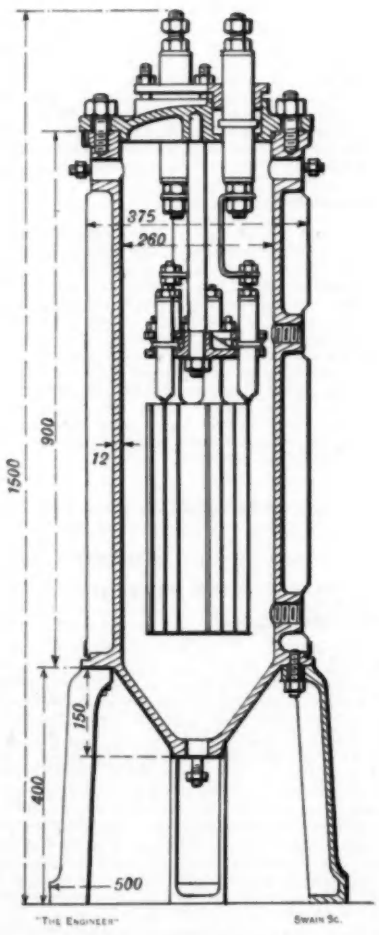
### General Motors' New Factory.

The huge new motor car factory being constructed by General Motors, South African, Ltd., at Sydenham, Port Elizabeth, will be completed by December 1st next. The area actually occupied by buildings is 8½ acres, the main factory building itself covering 6 acres, with a floor space of 259,200 square feet. The total floor space of all the buildings is 363,640 square feet. More than 750 tons of structural steel are being used and over 200 tons of reinforcing steel. The roofing calls for 135,000 square feet of iron roofing—about 7500 sheets—and 360,000 square feet asbestos roofing—about 14,000 sheets. In the concrete work 80,000 bags of cement are being used, 14,000 cubic yards of sand, and 30,000 cubic yards of stone. The present factory of the General Motors at Port Elizabeth was started in 1926, with 250 white employees, which had grown to 853 last year, with a pay roll of £213,836. Materials and supplies purchased in the Union and other expenditures made here grew from £111,990 three years ago to £353,394 last year. Import duties amounted to £353,394 last year. The factory is practically only an assembling establishment, but certain parts are made and also the bodies of the cars. The company, which only deals with American cars, by assembling the cars in the Union has reduced Customs duties to pay and so saves a very large amount per annum. So far no British firm has imitated its example, though it is understood that Morris Commercial Cars, Ltd., of Birmingham, has decided to erect such a factory at Durban.

## An Electric Boiler.

THE drawing which we reproduce below is a vertical section through an electrically heated boiler which is being made by Messrs. Bastian and Allen, of Farnham-road, Trading Estate, Slough.

Electric boilers have, of course, obtained a considerable vogue on the Continent, where hydro-electric power is




ELECTRIC BOILER

plentiful and fuel is scarce, and in America, but in this country there has not been the same incentive to the development of such plant on account of the comparative cheapness of coal. There are, however, some services in which the electric boiler is especially convenient, and it is consequently satisfactory to find that an English firm is taking up their manufacture, although the boiler in question is of Italian origin.

It is of that type in which three electrodes, connected with a three-phase supply circuit, are immersed directly in the water to be heated. The constructional details are so obvious in the cross section that it is not necessary to enlarge upon them here, but it should be pointed out that these boilers are remarkably small considering their output. That which we illustrate measures, it will be seen, a metre and a-half high and has a base of half a metre. When supplied with current at 500 volts it will absorb as much as 100 kW, and as its efficiency is about 99 per cent. it may be taken as the equivalent of 130 horse-power.

One of the great merits of these electric boilers is their ability to continue in operation, regardless of attention when once they have been set to fulfil the desired requirements. Thus the feed pump is the controller of the output of the boiler. If there is no water within there is no electric circuit, and as a consequence no heat is generated. But as the water level rises around the electrodes the path for the current increases and a corresponding increase in the current consumption is produced. Advantage is taken of this peculiarity to regulate the output of the boiler in the following manner. There is an electro-magnetic relay, connected with the supply circuit, which operates a valve in the feed supply in accordance with the voltage applied to the electrodes. That is to say, if the voltage rises on account of the reduced submergence of the electrodes, the rate of feed is increased so as to give a more free path for the current and *vice versâ*. In this way, it is claimed, the control of the output of the boiler can be maintained within 5 per cent. of the maximum. On the other hand, if the demand for steam decreases when the boiler is full of water, the consequent rise of pressure actuates another valve in the feed circuit and by-passes the water pumped. The result is that once the controls have been set the boiler is quite automatic in its action.

## Provincial Letters.

### THE MIDLANDS AND STAFFORDSHIRE.

*(From our own Correspondent.)*

#### Trade Situation.

LITTLE new business has been given out or entered upon in the heavy industries of the Midlands and Staffordshire this week. The weekly meeting in Birmingham of ironmasters was but sparsely attended, and very little material changed hands. The works are closing down at the end of the week for the August break of several days, and there are instances in this area where a full week's holiday will be the rule. Like producers of iron and steel, many manufacturers have reasonably good order books, and when plants are again put into operation they should run regularly and smoothly on for some time. The all-round demand is moderately good, and expectations of added market vigour in the near future are current in many of the Midland industries. Some of the heavy industries have been making a much better output than at the corresponding period last year, and raw materials have been in good demand. An increasing proportion of native material has been consumed of late in this neighbourhood, but the rising cost of this, together with the more attractive prices now being quoted for foreign material, are tending to make consumers waver in their adherence to home products. It is much to be hoped that when business is resumed native makers will be able to hold their own in the market and preserve for themselves the ground recently won from the foreigner.

#### Pig Iron Prices.

The action of the Central Pig Iron Producers' Association in declaring an advance of half-a-crown per ton on forge and foundry brands of Midland pig iron had little market effect, for, as had been pointed out in this column, premiums of this amount had been paid for supplies over the past fortnight. The advance puts the official minimum selling price at a level which up to a week ago had been recognised as the general market value, though admittedly it was the highest price conceded by buyers. Whether blast-furnacemen will now consider the new basis merely as representing minimum terms, and endeavour to obtain for their iron prices in advance of the basis, remains to be seen. At the weekly meeting of the trade in Birmingham to-day—Thursday—there was practically nothing done on account of the approaching holidays. Indeed, few buyers or sellers were in attendance, so that the position will remain obscure until after the holidays. The crux of the position is the furnace coke shortage. Coke is slowly appreciating, as smelters' requirements increase, and there are misgivings as to whether the supplies will be expanded to correspond with the additional blast-furnaces recently relighted. The reduction in the supply of coking slacks due to summer conditions presents a difficulty to the ovenmen. They are at the moment obtaining between 15s. and 16s. per ton for furnace coke, suitable for use in Midland furnaces. Should local furnacemen be called upon to pay anything in advance of this, there can be little doubt but that they will endeavour to pass on the increase to consumers of pig iron by asking premiums over the official minimum basis selling price fixed by their Association. These prices are:—Northamptonshire forge, £3 8s. 6d.; No. 1 foundry, £3 15s. 6d.; No. 2, £3 14s. 6d.; No. 3, £3 12s. 6d.; No. 4, £3 11s. 6d. Derbyshire forge, £3 12s.; No. 1 foundry, £3 19s.; No. 2, £3 18s.; No. 3, £3 16s.; No. 4, £3 15s.—all per ton delivered at Black Country stations.

#### Steel Values.

The heavy steel works in this district have a goodly array of orders on their books, and in view of some increased activity in shipbuilding and constructional engineering are expecting to add to the display. The offers of continental building steel at low prices have not, up to now, met with much success here. Structural engineers in this district are, in the main, pledged under the rebate scheme to confine their purchases to British material. Sellers of foreign small steel bars offer supplies at £6 15s. per ton, and so many inquiries are reported that native rollers have become somewhat nervous and some works are reported this week to have intimated their willingness to do business at £8 per ton, or 5s. below the recognised market level. On the other hand, there are rollers who, ignoring the continental situation, are asking prices in advance of £8 5s. per ton. Foreign competition in steel tube strip is also intensified. Overseas makers ask £7 7s. 6d., whereas native makers want from £8 2s. 6d. to £8 10s. Foreign 2in. billets are £6 per ton against £6 10s. demanded by British works. There has been no great displacement of business, but the situation created causes concern to Midland steel masters. Values of finished and semi-finished steel not mentioned above remain firm at last week's selling figures.

#### Finished Iron.

The finished iron trade in Staffordshire pursues an even course. There is a steady demand for the better qualities of iron and prices of marked bars are unchanged at £12 per ton. Crown bars at £10 sell moderately, local makers getting the orders when quality is an essential. Outside makers continue to offer Crown bars at rates much below those acceptable to Staffordshire houses. Business in nut and bolt and fencing bars is quiet, and here there is an increase in the competition from Belgium. Some very low prices are now being quoted by sellers of this latter material. Wrought iron tube strip has been advanced a further half-crown per ton, being now quoted £11 2s. 6d. This is stated to be a direct result of the increase in pig iron values.

#### Galvanised Sheets.

Demand for galvanised sheets remains quiet, though rather more inquiries have been in the market during the past week. Values of 24 gauge corrugated sheets are unchanged. Some mills are prepared to do business at £13 7s. 6d., while others, better placed, ask half a crown to 5s. above the minimum given here. There has been some falling off in demand for black sheets, but rollers have substantial contracts yet to be completed.

#### Scrap.

Heavy steel scrap is an easier market. The pressure brought to bear by users last week had its effect, and £13 7s. 6d. is now the general market level.

#### Birmingham District Canal Bridges.

The Birmingham Chamber of Commerce, realising the inadequacy of the canal bridges in the Birmingham and Black Country district, and the grave loss in transport efficiency resulting therefrom, are using every endeavour to get the business of converting these bridges into structures suitable for modern traffic expedited. They have recently approached the Minister of Transport and the Lord Privy Seal, setting out the essential difficulties, and recommending that the reconditioning of the bridges represented work of national development of first-class importance which should be put in the forefront of any programme adopted to relieve the present problem of unemployment. The Minister of Transport has replied directing attention to the Bridges Act of 1929, outlining the machinery set up to secure the transfer of bridges to local authorities, and intimating the intention of the Ministry to make grants from the Road Fund up to 75 per cent. of the approved cost falling upon the authorities. Whilst appreciating the action taken by the Ministry, the Birmingham Chamber feels that it is not sufficient to meet the needs of this district and that special measures are desirable, the position in this area being abnormal. It now suggests a co-ordinated scheme for the whole district, together with a more generous consideration to those congested areas in which large numbers of bridges are concentrated. To this end it has addressed to the Minister of Transport and the Lord Privy Seal a communication recommending the institution of an informal inquiry in the area with a view to bringing together representatives of the various local authorities, the canal company, the principal trading organisations, and the motoring interests, to obtain a complete picture of the position, to ascertain the precise difficulties to be overcome, and what additional relief could be given to those areas in which there was a concentration of from five to twenty bridges, and any other matters relevant to the problem.

#### City Council's Proposal to Take Over Nineteen Bridges.

The Public Works Committee of the Birmingham City Council proposes to negotiate, I learn, for the taking over of nineteen canal and railway bridges in the city, and to effect improvements at a total cost of £192,000. Eleven of the bridges are canal structures, and the remainder railway bridges. It is also proposed to make improvements to the bridge over the river Rea at Stirchley at a cost of £10,000, and to reconstruct the canal bridge in George-street at a cost of £1970.

#### Midland Slag Heaps.

Slag heaps in the Midlands are to provide work for five years for some 2000 unemployed. A scheme has just been approved whereby eight local authorities in the Midlands have undertaken, with the assistance of a Government grant, to level 300,000 slag heaps.

### LANCASHIRE.

*(From our own Correspondents.)*

MANCHESTER.

#### Creating a Disturbance.

IT is more or less a truism in this part of the country to regard the cotton and allied trades as the life-blood of industrial Lancashire, and the lock-out which has developed this week on the cotton trade employers' wage reduction proposals, particularly if the stoppage lasts for any length of time, will be a serious matter for

industry generally. So far as the engineering industries are concerned, however, the effect will be less pronounced than would otherwise have been the case had the cotton trade during the last eight or nine years not been in varying stages of depression. During that period, and especially during the last few years, financial stringency has virtually put a stop to the erection of new mills, and constructional engineers, therefore, have had little help from that quarter. For the same reason, the home demand for textile machinery has been at a low ebb, and general engineering concerns have been much less busy than usual in meeting the needs of the cotton and allied trades. In short, the reaction on the engineering industries has already been so acute that, unless the stoppage is an unusually prolonged one, further adverse influences are likely to be slight. Fortunately, if one may judge from general opinion here in authoritative quarters, an early settlement of the dispute may be expected.

### Financial Side of Engineering.

Although at the time of writing the financial results for the twelve months ending May 31st last of Edward Wood and Co., Ltd., constructional engineers, of the Ocean Ironworks, Manchester, have not been made public, a continuance of the recovery registered in the last few years seems to be foreshadowed by the fact that the directors have announced a final dividend on the ordinary shares of 4½ per cent., making a total distribution of 7 per cent. for the year. In the previous twelve months the ordinary dividend was 6 per cent., in 1926–27, 4 per cent., and in 1925–26, 2½ per cent., no distribution having been made in respect of the two years 1923–25. A marked contrast to this is provided in the financial statement for the year to June 30th last just issued by the directors of Fodens, Ltd., manufacturers of steam wagons, of Sandbach, Cheshire. The net profits for the twelve months amount only to £12,224, compared with £25,579 in the previous year, when the ordinary shareholders received a dividend of 6 per cent., and £27,725 in 1926–27, when a dividend of 7½ per cent. was paid.

### Manchester University Appointments.

Manchester University Council have appointed Mr. R. J. Cornish Lecturer in Engineering, and Mr. J. Allen Assistant Lecturer in Engineering.

### Non-Ferrous Metals.

There has been some further slight weakness apparent in the case of spelter, but, apart from that, conditions in the non-ferrous metals market during the past week have been steady to firm, a recovery having been made in certain sections, in which during recent weeks the tendency has been consistently downward. On balance tin has been about maintained at the level of prices ruling a week ago, although there has been some reaction from the highest point touched during the interim. The last issued returns relating to stocks of the metal in this country disclose a slight expansion, and that, no doubt, has tended to check the movement towards still higher prices in this section of the market, although another factor of perhaps equal importance has been profit-taking by speculators. A fair amount of interest is still being taken in the metal, however, and present indications seem to point to continued steadiness for the time being, at all events. Buying activity in the case of copper has been cautious and limited in extent, although values show a slight gain on balance compared with a week ago. Lead, also, has moved up a little, although still at a low level, compared with prices ruling a few weeks ago, and there has been no apparent improvement in the demand. With regard to spelter, inquiry in this section of the market is restricted and quotations are fractionally lower.

### Iron and Steel.

The advance in Midland foundry irons towards the end of last week appears to have checked for the time being new business, although sellers on this market continue to report satisfactory contract deliveries to Lancashire consumers. Quotations for delivery to works in the Manchester zone are now at 74s. 6d. per ton for Derbyshire iron, and 1s. more for Staffordshire, with Scottish brands at about 92s., Cleveland at 86s., and West Coast hematite at from 87s. 6d. to 88s. per ton, all delivered equal to Manchester. Inquiry for manufactured iron is comparatively slow still, and an important reduction in the price of foreign material is likely to handicap Lancashire firms still further in their fight for the nut and bolt market. Meanwhile prices are maintained at £10 15s. per ton for Crown quality bars and £9 15s. for seconds material. Apart from indications of continued weakness in small re-rolled bars, steel values are well held at recent levels, joists being quoted at £8 2s. 6d. per ton, tank plates at £8 17s. 6d., large bars at £9 2s. 6d., boiler plates at £9 17s. 6d., and small re-rolled bars at from £8 2s. 6d. to £8 5s. Apart from one or two important constructional jobs in progress or projected locally, most of the work in this section is of a relatively small and miscellaneous character and contract deliveries are of moderate weight in the aggregate. Small bars for bright-drawing purposes continue in active request, and the demand for locomotive building material is reasonably steady. Buying interest in the case of foreign iron and steel products offered here is slow, and a number of heavy price "cuts" have to be recorded, steel bars for delivery to Lancashire works being quoted at from £6 10s. to £6 12s. 6d. per ton, angles at £6 10s. to £6 15s., wire rods at £7 2s. 6d., joists at £6 10s., Thomas plates at about £7 7s. 6d., billets and sheets bars at £5 15s., and Belgian bar iron at £6 15s. per ton.

BARROW-IN-FURNESS.

### Hematites.

There is a steady demand for hematite pig iron on general home account. Local steel makers are taking fair deliveries, and business is held on overseas account for special iron. The weakness just now is in respect of steel makers, whose demands are by no means good. If they were, it would be necessary to increase production. The make of iron is sold to practically the end of the year, and a steady run of business generally is certain. There is, however, quite a lot of smelting plant idle, both in North Lancashire and Cumberland.

### Iron Ore.

The demand for hematite iron ore, mostly on local account, is steady. For the higher grade metals there is some trade doing with Scottish and East Coast smelters. Foreign importations of ore are quiet.

### Steel.

In the steel trade there is a fair amount of activity in both the Barrow and Workington steel centres, but the plant is by no means fully employed. Rails, the chief output, are in slow demand, both for home and overseas markets, and there are at present no signs of any improvement. There is a steady call for hoops, mostly for overseas, and a fair demand exists for bars and castings.

### Shipbuilding and Engineering.

The shipbuilding trade is in want of new orders, and the engineering trade has received a serious setback in the cancellation of orders for guns, for the British cruisers which were being built at the Dockyards.

## SHEFFIELD.

*(From our own Correspondent.)*

### Conditions in the Steel Trades.

A COMPREHENSIVE review of the various branches of the steel trades in Sheffield and district discovers the presence of both good and bad patches. While instances of full activity are to be found, there are also many others in which work is very short. The latter predominate, and it would appear on the whole that, so far from any general improvement having been registered, the quiet season has set in earlier than usual. On the bulk side of steel manufacture, activity is confined to the basic department, which continues to turn out a large output and to sell its goods freely. The Lincolnshire district is extending its resources for the production of such material. In acid steel, on the other hand, the output is at the lowest level which has been known for several years. The British railway companies are still ordering axles and tires very sparingly, while a big share of the overseas business is going to continental firms. The building of wagons is practically at a standstill. The cheering features of the situation are to be found in the special branches. The motor industry is an excellent customer for Sheffield steel and stampings, and at present the manufacturers of heavy vehicles in particular are making large demands upon the city. There is a better call for wire and wire rope than there was in the earlier part of the year. Engineering shows an improvement, and the shops devoted to it have been able to take on a considerable number of additional workmen lately.

### Price Difficulties.

The recent advances in the price of steel bars and billets are said to be interfering with the course of trade, as manufacturers of finished products are finding it difficult to obtain these advances from their customers. The difficulty is enhanced by the severity of competition, and the tendency to reduce prices in order to obtain business. There is no price cutting, however, in pig iron, billets, and certain classes of wire and wire rope, where it has been stopped as a result of the formation of associations to control selling rates. A matter of much concern to the manufacturers of tool steel is the rapid increase in the price of tungsten. This metal is largely used in the production of high-speed steel, and it is also employed to a less degree in other special steels. Whereas, towards the end of last year, ferro-tungsten could be bought at as low a price as 1s. 3d. per lb., it has now gone up to 3s. 3d., while tungsten powder has risen from less than 1s. 6d. to 3s. 6d. A considerable time ago, when prices were low, a number of the poorer mines producing wolfram ore were closed because of unprofitable working. Now the ore is scarce, and increasingly dear, and there is not likely to be any improvement until some of those mines are re-opened. The trade in high-speed steels is at present far from active, and is keenly competed for, so that the increase in the price of this important ingredient comes at an unwelcome moment.

### Unfavourable Factors.

The unsatisfactory position of the coal trade in South Yorkshire has had an unfavourable influence on the steel industries for some time. On the top of this has now come the trouble in the cotton industry, which, resulting in the stoppage of work at hundreds of mills, is bound to cause a lessened demand for Sheffield products. The decision of the Government to suspend work on the cruisers "Surrey" and "Northumberland" is another unsatisfactory feature, as regards not only its immediate effects, but also as to its bearing on future prospects. The building of a big warship calls for a considerable quantity of Sheffield products, including not only armour plate, but also steel castings, forgings, and tools. Some Sheffield firms had booked work in connection with the building of the two cruisers. The suspension is taken as a declaration of the Government policy with regard to armaments, and to mean that firms engaged in the production of armour plate and other parts of big vessels can expect nothing from the present Administration. A director of one of the largest firms said: "We have kept a lot of men on whom we could have paid off, in the hope that something would turn up, but now that the Government decision is announced it enables us to decide. It means that no further ships will be ordered, and therefore there will be no further need for us to retain our men, who are experienced and skilled in armament work. It will affect forgemen, people in the armour-plate and steel castings departments, machine men, patternmakers, and general labourers."

### The Government Steel Inquiry.

The constitution of the Government Committee to inquire into the iron and steel industry has not been received with satisfaction in Sheffield. Both manufacturers and workmen complain that they are not directly represented on it. "I am afraid we cannot hope for practical benefits for the steel trade from such a Committee," said one manufacturer. "What the trade wants," he added, "is to be left alone, to be given fresh air, and a fair chance. It is suffering from too many doctors. De-rating ought to help us substantially. Let us see what that will do." Another expressed the opinion that the only thing that would help the steel industry was Safeguarding. A third was dissatisfied with the appointment of a Committee at all, and advocated instead that the Government "should go the whole hog and establish an Efficiency Control Board, which could give a close insight into all matters regarding the selling of British goods. We can still produce the best goods, but what is needed, above all, is the scientific distribution of our wares."

### A Large Coke Oven Contract.

At the World Power Conference in London last autumn Sir David Milne Watson made the interesting announcement that the Gas Light and Coke Company was considering the erection of by-product ovens at its Beckton works for the manufacture of gas. This indicated the prospect of an interesting innovation, as a variety of reasons have hitherto combined to prevent the adoption in England of coke ovens in connection with gasworks. The firm chosen to erect the first ovens at the Beckton Works is the Koppers Coke Oven Company, Ltd., of Sheffield, which has secured the contract for a first installation, having a capacity of 1200 tons of Durham gas coal per day. This will be only the initial section of a great scheme, which is intended eventually to consist of four similar units, and which, when complete, will form one of the largest and probably the finest carbonising installation of its kind. The ovens will be of the Koppers twin-flued type with cross-over regenerators, thus embodying the well-known Koppers regenerative system with the advantages of the twin-flue construction. The installation will consist of sixty ovens, arranged in two batteries of thirty ovens in each, each oven having a capacity of 16 tons of coal per charge.

### Coal Distillation.

A substantial part of the Bussey coal distillation plant at Glenboig, Lanarkshire—which is said to be the largest plant of its kind in the world—is being supplied by G. P. Wincott and Co., Ltd., metallurgical furnace and constructional engineers, Sheffield. They are responsible, among other work, for the reinforced concrete structures complete, for the battery of retorts, 9-ton coal hopper and foundations, car dumper pit, complete with reinforced concrete coal hoppers of 20 tons and 30 tons capacity, and elevator pit.

### A Shipbuilding Order.

Cammell Laird and Co., Ltd., have booked a good order for ships, which will be built at their Birkenhead yard. The contract covers three vessels for the Canadian National Railway Company's Pacific Coast service. They will be 384ft. long and 57ft. in beam, and are expected to be put in commission early next summer. They will operate both a passenger and cargo service on the Pacific coast of Canada. They are designed by Messrs. A. T. Wall and Co., consulting naval architects, Liverpool, who will also supervise the construction.

### Two New Bridges.

Traffic problems at Thorne, near Doncaster, are likely to be relieved in the near future by the construction of two new bridges. In reply to a question in the House of Commons last week, the Minister of Transport stated that a scheme for the construction of a new bridge to replace the toll-bar bridge at Thorne had been approved for a grant from the Road Fund, that the County Council had accepted a tender, and that it was expected that the work would be commenced at an early date. The County Council had also completed arrangements for the construction of a bridge on a new site near Thorne to replace the drawbridge which carried the Bawtry–Selby road over the Dutch River, and the details of these proposals were now under consideration by the Ministry.

## NORTH OF ENGLAND.

*(From our own Correspondent.)*

### Iron Trade Activity.

IT is expected that the number of blast-furnaces in operation on the North-East Coast will shortly exceed fifty. This anticipation is encouraged by the news that the Cargo Fleet Iron and Steel Company, Middlesbrough, has started a third blast-furnace at its works this week, and that Bolckow, Vaughan and Co. are understood to be making arrangements for a similar rekindling of another of their furnaces at the South Bank Cleveland Works. The outlook in the Northern iron trade is very encouraging. Although there is usually a temporary slackening down at this period of the year, operative blast-furnace plant is producing at full output. Even so, it is taking the firms all their time to cope with the flow of business. In fact, foundry iron is so scarce that local founders are obtaining supplies from outside the district, and small quantities have been obtained even from Luxembourg. Since the beginning of the year, sixteen additional blast-furnaces have been brought into use, the number in operation now being forty-seven.

### Cleveland Iron Market.

Seasonal quietness is somewhat pronounced in the Cleveland pig iron market, but makers are looking forward to a brisk autumn home business, and are not without hope of some improvement in the export trade, though they fully realise that obstacles to expansion of transactions with overseas customers are very difficult to overcome. Some buyers seem disinclined to follow the

upward movement in quotations, but with production costs keeping makers' profits within narrow limits, price concessions cannot be expected. Cleveland pig iron is very difficult to obtain for early delivery. The few small lots merchants are able to offer are promptly snapped up at prices above the recognised market rates. Both makers and merchants are offering forward iron fairly freely, and sales over periods up to the end of the year are reported. No. 1 Cleveland foundry iron is 75s.; No. 3 G.M.B., 72s. 6d.; No. 4 foundry, 71s. 6d.; and No. 4 forge, 71s.

**Hematite Pig Iron.**

In the East Coast area hematite pig iron trade values are gradually moving upward, but orders are still accepted on comparatively low and quite unremunerative terms. Producers have little or no prompt iron for sale, and second hands are becoming less keen to enter into contracts at ruling rates. Terms of contract vary a good deal after individual bargaining. Both home and continental consumers are buying moderate parcels, and they state they can satisfy their requirements at the equivalent of ordinary qualities at 75s., but makers are asking up to 76s.

**Iron-making Materials.**

The stringent situation in the foreign ore trade is as acute as ever. Continued scarcity of tonnage keeps deliveries to consumers on an altogether inadequate scale, and some works are seriously feeling the shortage. New business is unheard of. Nominally, prices remain on the level of best Rubio at 24s. 6d., but there are no sellers on such terms. The scarcity of blast-furnace coke is not so acute as of late, but good average qualities remain firm at 21s. 6d. per ton, delivered to works on the North-East Coast.

**Manufactured Iron and Steel.**

Sales of manufactured iron and steel are far from numerous, but producers hope to book a few orders during the dull season, and as they have a considerable amount of work on hand, plant promises to be kept employed until the autumn buying sets in. Prices are not altered, but values of semi-finished steel are, if anything, a shade easier, owing to continental material being on offer at rather lower figures than have been ruling.

**The Coal Trade.**

The portents of fresh interferences in the coal trade, either in respect of lessened working hours or the introduction of selling agencies, are having a disturbing effect on forward trade in the Northern coal markets. Collieries are hesitating to sell ahead, and speculative business is practically out of the question. There is no lack of inquiries for coal of all kinds, and forward transactions would be freely entered into if only operators knew what is going to happen. An exporter asserted this week that thousands of tons of coal could be sold abroad if only there was a settled outlook and a freedom from the possibility of harmful interference. While the uncertainty lasts, it is possible that foreign coal-producing districts may pick up a large amount of trade that would otherwise have come to Northumberland and Durham. Still, the market maintains a firm undertone. The tonnage situation is getting better almost from day to day. The demand for boats is still prevalent, but it is not so acute as it has been. With more cargo space offering, the collieries are in a favourable position for early August. Northumberland steam coals are difficult to secure, and any odd prompt lots coming on to the market command full late prices. Gas coals of first quality are firmly held, but secondary sorts are rather more plentiful. Coking coal is less active than it has been, but prices are unchanged. Patent foundry cokes are the chief trade in the coke market just now. Ordinary kinds are selling readily at 22s. to 24s., while specials are in a steady way at 24s. to 26s. Beehive coke is also satisfactory at 18s. 6d. to 32s. 6d. Gas coke is passing through a quiet spell, but prices are held at 21s. 6d. to 22s.

## SCOTLAND.

*(From our own Correspondent.)*

**Quiet Conditions.**

THE effects of the holiday season are still apparent in the steel, iron and coal industries, and interest in the market is slow to revive. In the coal trade it should perhaps be noted, however, that considerable caution is being observed in view of possible Government intervention with regard to reorganisation of the industry. Reports concerning the shipbuilding industry have been a little more encouraging lately, and other sections of industry have shown some improvement, but, on the whole, the general outlook for the autumn and winter can hardly be termed satisfactory.

**Steel.**

Steelmakers have made a quiet restart after the holidays. Most producers have sufficient work on hand to provide immediate employment, but forward bookings have been small. Neither plates nor sections are too well placed. Black sheets are in a steady demand, and prices are comparatively firm. Galvanised sheets show a fair amount of business on hand, but there is ample room for improvement in forward bookings. Tubes are still favourably placed, and an improvement is noted in the demand for constructional steel.

**Iron.**

Bar iron has been a shade busier owing to the placing of orders held up during the holiday stoppage, but there is no indication of a sustained improvement. Re-rolled steel is similarly placed, and prices are upheld chiefly by costs of production. Re-rolled steel is quoted £8 home and £7 15s. per ton export.

**Pig Iron.**

The pig iron market has continued comparatively idle since the resumption. Prices remain firm on the agreed basis.

**Coal.**

In most districts the output of fuel is fairly well sold over the next four weeks. Further than that, however, neither producers nor exporters are prepared to go in view of the attitude of the Government already referred to. Shipping business on the whole is comparatively light, but outputs are not excessive, and certain qualities are none too plentiful. Though hardly scarce in supply, the production of Lanarkshire splints is fully sold until the end of August, and prices are firm. Lothian steams are a shade stronger for prompt shipment. The Fifeshire collieries have sufficient orders to account for their immediate output of steams, third-class varieties of which have shown an improvement of late. In all districts washed nuts are easily disposed of at full recent prices. Aggregate shipments amounted to 211,258 tons, against 168,837 tons in the preceding week and 204,649 tons in the same week last year.

**Better Conditions in the Motherwell District.**

The position of the steelworks in Motherwell may be termed rather bright at the moment. Recent orders necessitated a curtailment of the annual holidays, and since the restart some important contracts have come to hand, including one for 100 double-decked car bodies for the London County Council, which has been secured by Hurst, Nelson and Co., Ltd. Bridge-building firms in this district too are very busy on foreign contracts.

## WALES AND ADJOINING COUNTIES.

*(From our own Correspondent.)*

**Coal Trade Conditions.**

CONDITIONS in the steam coal trade have not greatly altered during the past week, but still they are a shade better. The chartering of tonnage has been a little more active, and as a consequence the docks are busier. This is only to be expected immediately before holidays, when there is a desire on the part of shippers and shipowners to get vessels loaded and sailed before the vacation, as otherwise it practically means that steamers have to wait in dock for the best part of a week. The inquiry for coals has not broadened to any material extent, and remains quiet, but there is a prospect that the conditions will from September display some improvement. This is looked for, and as a consequence sellers are not prepared to discount present prices for coals for delivery later in the year; rather are sellers inclined to advance their ideas. For the moment, however, the trouble is that collieries cannot find sufficient orders for their output of large coals. A few collieries are well placed in this respect, but others are less fortunate, and it is restricting their production of other qualities. The result is that some colliery salesmen are not disposed to make sales of smalls unless buyers are prepared to take a proportion of large coals. Notwithstanding the comparative quietness prevailing, it is interesting to note that the returns of foreign exports last week were nearly 554,000 tons, as against nearly 490,000 tons the previous week. At the end of last week there were as many as twenty-two idle tipping appliances at the various docks, but week-end arrivals of steamers improved the situation to some extent, as on Monday last the number of idle appliances was sixteen and there were eleven steamers waiting to berth. Business ahead shows no special feature and the only contract reported to have been placed lately is that for about 30,000 tons of best Welsh small coals for delivery over a period of three months for the Portuguese State Railways.

**Coalfield and Docks Holidays.**

It has been arranged that the holidays in the coalfield next week shall be three days, viz., Monday, Tuesday, and Wednesday. So far as the shipment of coals is concerned, it has been arranged that the trimmers and tippers at South Wales ports shall have holidays on Monday and Tuesday, but two short shifts will be worked on the Wednesday, viz., from 8 a.m. to noon, and from 12 noon to 4 p.m. Ordinary work will be resumed on Thursday, August 8th.

**Cambrian Collieries and New Grouping Proposal.**

Since writing last week, the announcement has been made that the Cambrian Combine Collieries, which have been in liquidation, have been purchased by Sir D. R. Llewellyn, Bart., on behalf of Guest, Keen and Nettlefolds, Ltd., for the sum of £745,000. These collieries comprise the Cambrian, Glamorgan, Britannic and Naval undertakings, having thirteen pits and employing about 7500 workmen. The collieries cover an area of about 6870 acres, with an annual output capacity of over 2,000,000 tons of coal, and estimated available resources aggregating over 66,000,000 tons. Official news regarding the acquisition of these pits has been awaited with considerable interest, in view of the rumours which have been current respecting negotiations for bringing about a huge amalgamation of interests between leading concerns in this district. There has been talk of an immense linking up of existing combines, but there is now good reason to state that these negotiations have now come to an end and have been abandoned. What is regarded as more likely, and is stated to be definitely contemplated, is the linking up of all the colliery undertakings in which Guest, Keen and Nettlefolds, Ltd., Sir D. R. Llewellyn, Mr. W. M. Llewellyn, and Gueret, Llewellyn and Merrett, Ltd., are interested. They include not only the Cambrian group of collieries, but Messrs. D. Davies and Sons' pits, North's Navigation collieries, Bwllfa and Cwmamman pits, Meiros collieries, Nixon's and Welsh Navigation and pits belonging to Sir D. R. Llewellyn. It is stated that the scheme in view involves reorganisation not only on the production side, but rearrangements in regard to the selling.

**The Steel Trade.**

Conditions in the steel trade are quiet and reports show that many of the largest concerns in this district are running at half pressure. According to one authority, these conditions are largely due to the depression in the galvanised sheet and tin-plate trades, upon which steel makers are so much dependent for orders. It is also stated that the galvanised sheet industry is severely hit by the loss of the Japanese market, owing to the fact that Japan is now satisfying its own requirements. Another cause of the depression is the unrest in certain foreign countries which normally provide markets for Welsh commodities.

**Current Business.**

The tone of the market for large coals remains practically unchanged, and many collieries are still in need of prompt orders. Prices are still on the minima, but smalls are very firm and many sellers have increased their prices in view of the holidays and the further restriction in production. Unless sellers can get an order which embraces a proportion of large coals they decline to sell smalls. Although the market may not be brisk, it is expected that the conditions after the vacation will be very steady, in view of the loss of half a week's production. Patent fuel is also steady and works are well booked up. Coke finds a ready outlet. The pitwood market is very firm at round about 32s. 6d. The explanation is that the wood cutters in France have to a large extent gone on harvesting operations, and cutting of wood is largely suspended, and supplies coming forward are very limited. It is probable that the market for pitwood will continue firm throughout the whole of August.

## B.E.S.A. SPECIFICATIONS.

### PIPE FLANGES.

BRITISH Standard Tables of Pipe Flanges for Land Use, Part 3, for Working Steam Pressures above 450 lb. and up to 600 lb. per square inch, have recently been published by the British Engineering Standards Association.

The new specification, No. 10, Part 3, gives the definitions of flanges and bolting for nominal pipe sizes of ½in. to 16in. inclusive. The material specified for these high-pressure flanges is cast iron or steel.

For temperatures of 750 deg. Fah. and up to 870 deg. Fah. the use of special alloy steel is recommended for bolts, which should have nuts at both ends. Copies of this new British Standard Specification may be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

## CONTRACTS.

CLAYTON, SON AND CO., Ltd., of Hunslet, Leeds, have received an order from the Birmingham Corporation for about 3 miles of 62in. diameter mild steel water mains, concrete lined, for an extension to the Elan supply system.

UNITED WATER SOFTENERS, Ltd., has recently received from twenty separate customers in this country and other parts of the world, orders for water filtering or treatment plants of various types, having a combined capacity of upwards of 4,500,000 gallons per day.

JOHN M. HENDERSON AND CO., Ltd., of Aberdeen, have received from Sir John Jackson (Singapore), Ltd., the main contractors for the Singapore naval base, an order for eight electrically driven travelling aerial cableways for the construction of the docks, dock walls, and wharves at that base. These cableways are to handle loads of 5 tons and to have spans varying from 350ft. to 860ft.

THE ENGLISH ELECTRIC COMPANY has received an order from the Nottingham Corporation tramways for six double-deck, top-covered, six-wheel, electric trolley omnibuses. Each vehicle will have a seating capacity for sixty passengers. The equipment will consist of an 80 H.P. motor and standard foot-operated cam shaft controller. The same company has also received an order from the London County Council for fifty double-deck all-steel tramcars and 100 motor equipments. The cars will each have seating accommodation for 28 passengers in the lower saloon and 46 passengers in the upper saloon. The equipments will each consist of two 57·5 H.P. motors with controllers, circuit breakers, resistances, cabling and trolleys.

## CATALOGUES.

BLACKSTONE AND CO., Ltd., Stamford.—A folder describing a range of portable pumping plants.

OXLEY ENGINEERING COMPANY, Ltd., Leeds.—A catalogue of electric resistance welding and heating machines.

BRITISH STEEL PILING COMPANY, Ltd., 54A, Parliament-street, S.W. 1.—Pamphlet on "Larssen" steel piling.

STEELE AND COWLISHAW, Cooper-street, Hanley, Stoke-on-Trent.—A pamphlet dealing in some detail with the "Steele-Shaw" flexible coupling.

DRAYTON REGULATOR AND INSTRUMENT COMPANY, Ltd., West Drayton, Middlesex.—A leaflet describing the P.B. thermo-electric surface pyrometer.

UNITED STEEL COMPANIES, Ltd., 17, Westbourne-road, Sheffield.—Pocket sized booklet setting out the various sections of steel strip available for use.

ALLOY WELDING PROCESSES, Ltd., Ferry-lane Works, Walthamstow, E. 17.—Bulletin No. 60 on welding stainless steels with special reference to "A.W.P." electrodes.

HEAD, WRIGHTSON AND CO., Ltd., Norton-road, Stockton-on-Tees.—Particulars of the "Colorado" convertible discharge ball mill, and a descriptive booklet on "The Kirkless Slurry Separator."

THOR LAMPS AND SUPPLIES, Ltd., Thor Works, Tredegar-street, Cardiff.—Descriptive leaflets. L.I./429, type N.F.E. Thor electric safety lamps; S.L.I./629, Thor electric miners' safety lamps, type S. and S.P.; leaflet, describing the latest type Double Charging Stand for S., S.P. and B. type lamps.

# Current Prices for Metals and Fuels.

## IRON ORE.

| | |
|---|---|
| N.W. Coast— | |
| (1) Native | 19/6 to 22/- |
| (1) Spanish | 24/- |
| (1) N. African | 24/- |
| N.E. Coast— | |
| Native | 18/- to 21/- |
| Foreign (c.i.f.) | 24/6 |

## PIG IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| (2) Scotland— | | |
| Hematite | 4 0 0 | — |
| No. 1 Foundry | 3 18 6 | — |
| No. 3 Foundry | 3 16 0 | — |
| N.E. Coast— | | |
| Hematite Mixed Nos. | 3 15 6 | 3 15 6 |
| No. 1 | 3 16 0 | 3 16 0 |
| Cleveland— | | |
| No. 1 | 3 15 0 | 3 15 0 |
| Silicious Iron | 3 15 0 | 3 15 0 |
| No. 3 G.M.B. | 3 12 6 | 3 12 6 |
| No. 4 Foundry | 3 11 6 | 3 11 6 |
| No. 4 Forge | 3 11 0 | 3 11 0 |
| Mottled | 3 10 6 | 3 10 6 |
| White | 3 10 6 | 3 10 6 |
| Midlands— | | |
| (3) Staffs.— | (*Delivered to Station*) | |
| All-mine (Cold Blast) | — | — |
| North Staffs. Forge | 3 11 0 | — |
| ,, ,, Foundry | 3 13 6 | — |
| (3) Northampton— | | |
| Foundry No. 3 | 3 12 6 | — |
| Forge | 3 8 6 | — |
| (1) Derbyshire— | | |
| No. 3 Foundry | 3 16 0 | — |
| Forge | 3 12 0 | — |
| (3) Lincolnshire— | | |
| * No. 3 Foundry | 3 12 6 | — |
| No. 4 Forge | — | — |
| Basic | — | — |
| (4) N.W. Coast— | | |
| N. Lancs. and Cum.— | | |
| Hematite Mixed Nos. | 4 5 6 (*a*) / 4 7 6 (*b*) / 4 11 0 (*c*) | — |

## MANUFACTURED IRON.

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| Scotland— | | |
| Crown Bars | 10 5 0 | 9 15 0 |
| Best | — | — |
| N.E. Coast— | | |
| Iron Rivets | 11 10 0 | — |
| Common Bars | 10 15 0 | — |
| Best Bars | 11 5 0 | — |
| Double Best Bars | 11 15 0 | — |
| Treble Best Bars | 12 5 0 | — |
| Lancs.— | | |
| Crown Bars | 10 15 0 | — |
| Second Quality Bars | 9 15 0 | — |
| Hoops | 13 0 0 | — |
| S. Yorks.— | | |
| Crown Bars | 11 0 0 | — |
| Best Bars | 11 10 0 | — |
| Hoops | 12 0 0 | — |
| Midlands— | | |
| Crown Bars | 10 0 0 | — |
| Marked Bars (Staffs.) | 12 0 0 | — |
| Nut and Bolt Bars | 9 0 0 to 9 5 0 | — |
| Gas Tube Strip | 11 0 0 to 11 2 6 | — |

## STEEL. (*d*)

| | (6) Home. £ s. d. | (7) Export. £ s. d. |
|---|---|---|
| (5) Scotland— | | |
| Boiler Plates (Marine) | 10 10 0 | 10 0 0 |
| ,, ,, (Land) | 10 0 0 | 10 0 0 |
| Ship Plates, ¾in. and up | 8 12 6 | 7 12 6 |
| Sections | 8 2 6 | 7 2 6 |
| Steel Sheets, ¼in. | 9 0 0 | 8 7 6 |
| Sheets (Gal. Cor. 24 B.G.) | 13 17 6 | 13 12 6 to 13 15 0 |

## STEEL (*continued*).

| | Home. £ s. d. | Export. £ s. d. |
|---|---|---|
| N.E. Coast— | | |
| Ship Plates | 8 12 6 | — |
| Angles | 8 2 6 | — |
| Boiler Plates (Marine) | 10 10 0 | — |
| ,, ,, (Land) | 10 0 0 | — |
| Joists | 8 2 6 | — |
| Heavy Rails | 8 10 0 | — |
| Fish-plates | 12 0 0 | — |
| Channels | 10 5 0 | £9 to £9 5s. |
| Hard Billets | 8 2 6 | — |
| Soft Billets | 6 17 6 | — |
| N.W. Coast— | | |
| Barrow— | | |
| Heavy Rails | 8 10 0 | — |
| Light Rails | 8 15 0 to 9 0 0 | — |
| Billets | 6 15 0 to 9 10 0 | — |
| Manchester— | | |
| Bars (Round) | 9 2 6 | — |
| ,, (Small Round) | 8 5 0 | — |
| Hoops (Baling) | 10 0 0 | 9 15 0 |
| ,, (Soft Steel) | 9 0 0 | 8 15 0 |
| Plates | 8 17 6 to 9 2 6 | — |
| ,, (Lancs. Boiler) | 9 17 6 | — |
| Sheffield— | | |
| Siemens Acid Billets | 9 10 0 | — |
| Hard Basic | 9 2 6 and 9 12 6 | — |
| Intermediate Basic | 7 12 6 and 8 2 6 | — |
| Soft Basic | 7 0 0 | — |
| Hoops | 9 10 0 to 9 15 0 | — |
| Soft Wire Rods | 8 10 0 | — |
| Midlands— | | |
| Small Rolled Bars | 8 0 0 to 8 15 0 | — |
| Billets and Sheet Bars | 6 12 6 to 6 15 0 | — |
| Sheets (20 W.G.) | 11 10 0 to 12 0 0 | — |
| Galv. Sheets, f.o.b. L'pool | 13 7 6 to 13 12 6 | — |
| Angles | 8 2 6 | — |
| Joists | 8 2 6 | — |
| Tees | 9 2 6 | — |
| Bridge and Tank Plates | 8 17 6 | — |
| Boiler Plates | 9 12 6 | — |

## NON-FERROUS METALS.

| | |
|---|---|
| Swansea— | |
| Tin-plates, I.C., 20 by 14 | 18/1½ to 18/6 |
| Block Tin (cash) | 213 12 6 |
| ,, ,, (three months) | 217 7 6 |
| Copper (cash) | 73 5 0 |
| ,, (three months) | 73 15 0 |
| Spanish Lead (cash) | 23 0 0 |
| ,, ,, (three months) | 23 2 6 |
| Spelter (cash) | 25 3 9 |
| ,, (three months) | 25 6 3 |
| Manchester— | |
| Copper, Best Selected Ingots | 75 5 0 |
| ,, Electrolytic | 85 0 0 |
| ,, Strong Sheets | 110 0 0 |
| ,, Tubes (Basis Price), lb. | 0 1 3 |
| Brass Tubes (Basis Price), lb. | 0 1 1 |
| ,, Condenser, lb. | 0 1 3 |
| Lead, English | 24 10 0 |
| ,, Foreign | 23 0 0 |
| Spelter | 25 7 6 |
| Aluminium (per ton—raw ingot) | £95 |

## FERRO ALLOYS.

| | Per Ton. | Per Unit. |
|---|---|---|
| Tungsten Metal Powder | 3/6½ per lb. | |
| Ferro Tungsten | 3/3½ per lb. | |
| Ferro Chrome, 4 p.c. to 6 p.c. carbon | £24 0 0 | 7/6 |
| ,, ,, 6 p.c. to 8 p.c. | £23 0 0 | 7/- |
| ,, ,, 8 p.c. to 10 p.c. | £23 0 0 | 6/6 |
| ,, ,, Specially refined | | |
| ,, ,, Max. 2 p.c. carbon | £34 0 0 | 12/- |
| ,, ,, ,, 1 p.c. carbon | £38 0 0 | 15/- |
| ,, ,, ,, 0·70 p.c. carbon | £42 0 0 | 17/- |
| ,, ,, ,, carbon free | 1/2 per lb. | |
| Metallic Chromium | 2/6 per lb. | |
| FerroManganese (per ton) | £13 15 0 for home; £13 10 0 for export | |
| ,, Silicon, 45 p.c. to 50 p.c. | £12 0 0 scale 5/- per unit | |
| ,, ,, 75 p.c. | £19 10 0 scale 6/- per unit | |
| ,, Vanadium | 13/- per lb. | |
| ,, Molybdenum | 4/- per lb. | |
| ,, Titanium (carbon free) | 1/- per lb. | |
| Nickel (per ton) | £170 to £175 | |
| Ferro-Cobalt | 9/4 per lb. | |

## FUELS.

### SCOTLAND.

(*Prices not stable.*)

| | Export. |
|---|---|
| Lanarkshire | |
| (f.o.b. Glasgow)—Steam | 13/6 |
| ,, ,, Ell | 14/- to 14/3 |
| ,, ,, Splint | 15/6 to 16/9 |
| ,, ,, Trebles | 15/3 |
| ,, ,, Doubles | 14/3 |
| ,, ,, Singles | 12/9 |
| Ayrshire— | |
| (f.o.b. Ports)—Steam | 13/6 |
| ,, ,, Jewel | 16/6 |
| ,, ,, Trebles | 14/9 to 15/- |
| Fifeshire— | |
| f.o.b. Methil or Burntisland—Steam | 12/- to 15/- |
| Screened Navigation | 17/6 to 18/6 |
| Trebles | 15/9 to 16/- |
| Doubles | 14/6 |
| Singles | 12/6 to 12/9 |
| Lothians— | |
| (f.o.b. Leith)—Best Steam | 13/6 |
| Secondary Steam | 13/- |
| Trebles | 15/- to 15/3 |
| Doubles | 14/3 |
| Singles | 12/6 |

### ENGLAND.

| | |
|---|---|
| (8) N.W. Coast— | |
| Steams | 24/- to 25/- |
| Household | 38/- to 51/- |
| Coke | 26/- to 26/6 |
| Northumberland— | |
| Best Steams | 14/6 to 15/- |
| Second Steams | 13/9 to 14/- |
| Steam Smalls | 9/6 to 10/6 |
| Unscreened | 13/- to 13/6 |
| Household | 21/- to 26/- |
| Durham— | |
| Best Gas | 16/6 to 16/9 |
| Second | 16/- to 16/6 |
| Household | 21/- to 27/- |
| Foundry Coke | 22/- to 28/- |
| Sheffield— | Inland. |
| Best Hand-picked Branch | 25/6 to 26/6 — |
| Derbyshire Best Bright House | 19/- to 21/- — |
| Best House Coal | 19/6 to 20/6 — |
| Screened House Coal | 17/6 to 18/6 — |
| ,, ,, Nuts | 15/6 to 16/6 — |
| Yorkshire Hards | 15/- to 16/- — |
| Derbyshire Hards | 15/- to 16/- — |
| Rough Slacks | 9/- to 10/- — |
| Nutty Slacks | 7/- to 8/- — |
| Smalls | 3/- to 5/- — |
| Blast-furnace Coke (Inland) | 14/6 at ovens — |
| Furnace and Foundry Coke (Export), f.o.b. | 21/- to 22/- |

### (9) SOUTH WALES.

| | |
|---|---|
| Cardiff— | |
| Steam Coals : | |
| Best Smokeless Large | 19/9 to 20/- |
| Second Smokeless Large | 19/6 to 19/9 |
| Best Dry Large | 18/9 to 19/- |
| Ordinary Dry Large | 17/9 to 18/3 |
| Best Black Vein Large | 18/- to 18/3 |
| Western Valley Large | 17/9 to 18/- |
| Best Eastern Valley Large | 17/9 to 18/- |
| Ordinary Eastern Valley Large | 17/3 to 17/9 |
| Best Steam Smalls | 13/9 to 14/6 |
| Ordinary Smalls | 12/6 to 13/- |
| Washed Nuts | 20/- to 23/6 |
| No. 3 Rhondda Large | 20/- to 21/- |
| ,, ,, Smalls | 15/6 to 16/- |
| No. 2 ,, Large | 17/- to 17/6 |
| ,, ,, Through | 15/6 to 16/6 |
| ,, ,, Smalls | 13/6 to 14/- |
| Foundry Coke (Export) | 26/6 to 36/6 |
| Furnace Coke (Export) | 21/- to 23/- |
| Patent Fuel | 20/- to 21/6 |
| Pitwood (ex ship) | 32/6 to 33/- |
| Swansea— | |
| Anthracite Coals : | |
| Best Big Vein Large | 33/- to 36/6 |
| Seconds | 27/6 to 30/- |
| Red Vein | 23/- to 27/- |
| Machine-made Cobbles | 40/- to 44/- |
| Nuts | 40/- to 44/- |
| Beans | 23/6 to 25/6 |
| Peas | 18/- to 19/- |
| Breaker Duff | 9/- to 9/6 |
| Rubbly Culm | 10/3 to 10/9 |
| Steam Coals : | |
| Large | 18/- to 19/- |
| Seconds | 17/- to 18/- |
| Smalls | 11/3 to 13/- |
| Cargo Through | 15/6 to 16/6 |

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum) 12/6

Ordinary Ship, Bridge and Tank Plates and Sections 10/- if home consumers confine purchases from associated British Steel Makers.

# French Engineering Notes.

*(From our Correspondent in Paris.)*

### German Machinery.

THE arrangement whereby Germany supplies France with goods on account of reparations has proved quite satisfactory for both countries, and while the system involves, of course, a financial loss to Germany, it is of great benefit to industry, which has probably developed far more rapidly than would have been possible without the reparation material. The following figures will give some idea of the extent of these reparations. During the first five months of the year Germany supplied Diesel engines to the value of 1,917,730f.; locomotives, 2,784,121f.; traction engines, 3,916,561f.; elevating machinery, 9,076,585f.; structural material, 15,314,760f.; and textile machinery, 29,527,849f. These are only a few of the mechanical products imported. As the import duties on reparation material have now been suppressed, the utilisation of such goods will be still further facilitated. There is no doubt that this has also helped German manufacturers to increase their business apart from reparations, for the use of so much German machinery in this country naturally leads buyers to apply to firms they know for any special machines that are not manufactured at home. During the first half of the year the Germans exported 40 per cent. of their machinery production, and in view of the steady augmentation they believe that the proportion of machines exported will soon reach 50 per cent. The value of the machinery exported is also consistently increasing. The German mechanical engineering firms are said to be working up to 70 per cent. of their capacity. In other directions also German producers are making great efforts to develop their export trade. The Rhenish-Westphalian Coal Syndicate is improving its organisation of coal consignments from the Ruhr to France, and this will affect more particularly the French and Belgian coal-owners, but if the German competition should prove too severe French coalowners may be compelled to renew their attack on the south-western districts that are largely monopolised by British coal. During the first six months Rouen imported more than 630,000 tons of British coal in excess of the total for the corresponding half of last year.

### Paris Extension.

About a year ago a committee was formed to prepare the carrying out of a scheme for extending Paris to the limits of the Seine Department, and even to include parts of the Seine et Oise and Seine et Marne, the object being to establish a definite plan which would provide for the artistic arrangement of the city and preserve it, as far as possible, from the industrial invasion which has taken place in all the suburbs. At present Paris is surrounded by factories, and the extension of the city beyond them offers a problem that is not easy of solution. The committee has just issued a first report, and presents the text of a Bill that will be introduced into the Chamber of Deputies for the drawing up of a plan within a period of eighteen months, together with the financial proposals for carrying it out. This preliminary report suggests the creation of zones around Paris, one for residential houses, one for factories and another for workmen's dwellings. It is also proposed to create what are called "satellite cities," the first of which is already being laid out at Courneuve in the northern suburbs. They will, in fact, be something after the nature of garden cities. Paris will also extend as far as Saint-Germain by means of a boulevard which will become a fashionable residential artery the whole distance. Parallel with the boulevard there will be an electric railway. In view of the vast amount of building involved it is proposed to create a technical organisation known as the Securitas, which will ensure that constructions are carried out properly.

### West African Development.

Out of a total of 3000 million francs which it is intended to raise by loan in order to carry out the work of colonial development, nearly one-half of that amount will be devoted to harbour, railway, road and other undertakings in French West Africa. On the extensive seaboard of the West African Colony there are no natural ports, and those that exist have had to be created by means of breakwaters and continuous dredging, while most of them are badly supplied with fresh water. The construction of ports under these conditions is a noteworthy engineering achievement. Dakar has developed into one of the biggest ports on the West African coast. Saint-Louis suffers from an encroachment of the sea which threatens a part of the town, and at other ports there is a perpetual dredging of shifting sands. A new port will be created near Abidjan, which has already become wholly insufficient for the increasing traffic. Extensive works are also to be carried out at Konakry and Cotonou. There is to be a considerable expenditure on the railways, beginning with the Kayes-Niger line, which is much too light, and will have to be practically reconstructed. More than 1000 million francs will be devoted to railway improvements and to the building of new lines. Other works comprise the irrigation of the Niger Valley, the drainage of marsh lands, which are a menace to the health of both white and native populations, and the provision of towns on the coast with water. All this involves an enormous amount of material, which will be supplied partly by Germany on account of reparations and partly by French makers.

### Barrage Reservoirs.

The financial arrangements for the construction of the barrage reservoirs in the upper basin of the Seine have been so far advanced that there is every prospect of the work being started upon at a comparatively early date. The programme will be carried through in two stages, the first being the Pannesière barrage in the valley of the Yonne, and then others in the valley of the Cure and in the Marne and Haute-Marne, while the second stage will be the construction of the Chantecoq, Grand Orient and Serein reservoirs. Then will follow the installation of hydro-electric plants at the various barrages.

# British Patent Specifications.

*When an invention is communicated from abroad the name and address of the communicator are printed in italics.*

*When an abridgment is not illustrated the Specification is without drawings.*

*Copies of Specifications may be obtained at the Patent Office Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.*

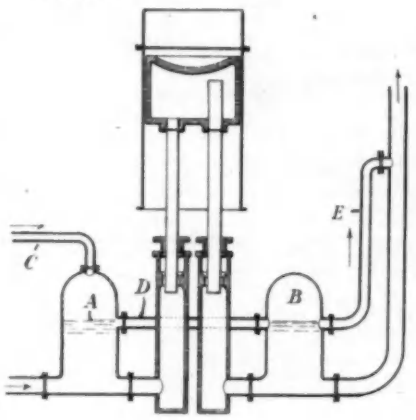
*The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.*

## INTERNAL COMBUSTION ENGINES.

314,290. October 13th, 1928.—COOLING PISTONS, H. Wach, 9, Blumenthalstrasse, Bremen, Germany.

To minimise the shocks in a piston water-cooling system caused by the reciprocation of the piston, the inventor introduces the air vessels A and B into the inlet and outlet pipes. These

Nº 314,290




vessels are fed with compressed air by the pipe C and connecting branch D. E is an outlet for any surplus air. It is explained that the several branches must be so proportioned that there is no liability for the air to force all the water out of the vessels and find its way into the piston.—*June 27th*, 1929.

314,299. November 23rd, 1928.—TWO-STROKE GAS ENGINES, *L. Mellersh-Jackson, 28, Southampton-buildings, Chancery-lane, London, W.C. 2.*

The scavenging air inlet ports A and the gas inlet ports B are arranged approximately in one plane and, as can be seen from Fig. 2, in such a manner that the air and gas ports alternately follow one another in the direction of the cylinder circumference. The gas inlet ports are made less in height than the scavenging air inlet ports, so that the latter are first of all uncovered by the piston and scavenging air is first of all admitted to the cylinder; this air pushes the exhaust gases in front and thus acts as a separating layer between the exhaust gases and the following fresh gases. The air inlet ports A and the gas inlet ports B are made in the shape of a trapezoid—*i.e.*, a quadrilateral figure with two parallel sides and two converging sides—

Nº 314,299

Fig 1.

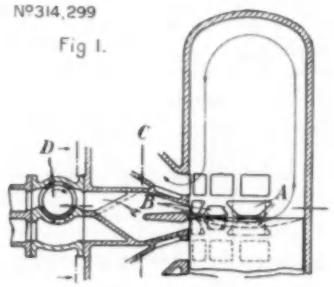
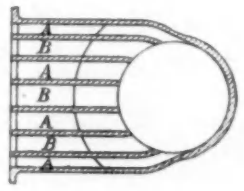



Fig 2



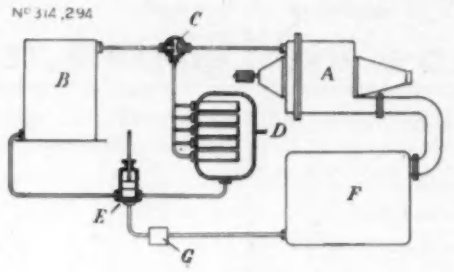

and are arranged in such a manner that, in the case of the air inlet ports, the longer sides are nearer than the shorter sides to the cylinder head, and in the case of the gas inlet ports the shorter sides are nearer than the longer sides to the cylinder head. This ensures that plenty of air can freely enter the cylinder prior to the opening of the gas inlet ports. The scavenging air flows, as is well known, to the cylinder head, followed by the air and gas mixture. The scavenging medium reverses its direction of flow at the cylinder head and passes out through the exhaust ports C which are arranged nearer to the cylinder head than the inlet ports and are situated on the same side of the cylinder wall as the inlet ports. The gas control valve D is so arranged that, when the gas is cut off, there is free access for air to the engine to clear away any unconsumed gas.—*June 27th*, 1929.

## TURBINE MACHINERY.

314,294. October 25th, 1928.—VAPOUR TURBINES, E. W. Bräuer, Kunz-Buntschuhstrasse 4, Berlin-Grunewald, Germany.

The inventor propounds a scheme in which a steam turbine A is supplied at its nozzles with water heated to a temperature above that of its evaporation at the immediate temperature. The water heater is shown at B. He considers that a dangerous pressure is liable to be developed in the heating system if the turbine is controlled by a plain throttle valve, so he introduces the three-way valve C. When the supply of heated water is

Nº 314,294



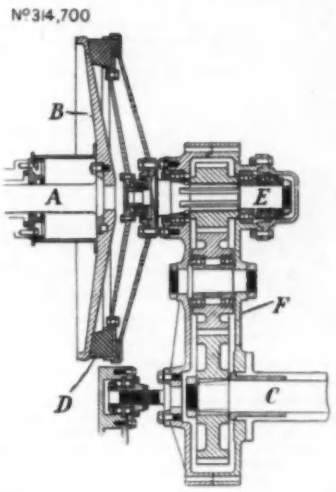

cut off from the turbine with the object of stopping it, the water is diverted to the feed heater D and goes back, *viâ* the feed pump E, to the main heater B. F is a condenser and G a non-return valve.—*June 27th*, 1929.

## TRANSMISSION OF POWER.

314,700. July 27th, 1928.—VARIABLE-SPEED GEAR, J. H. Robertson, 1, Albemarle-street, London, S.W. 1.

This gear is of that type in which the driven member, in the form of a friction annulus, is moved across the face of a driving cone, so that it may engage with a surface running at a different pheripheral speed, according to its position. The driving shaft is shown at A, with its conical disc B. The driven shaft is marked

Nº 314,700




C. The annular friction member D is mounted on the shaft E within the radial casing F. A train of gears transmits power from the annulus to the driven shaft. It is pointed out that the torque produced in the casing F tends to move the two friction members into the position where the speed ratio is greatest, while the axial thrust caused by the conical formation of the surfaces has the opposite effect.—*July 4th*, 1929.

## MACHINE TOOLS AND SHOP APPLIANCES.

301,483. September 26th, 1928.—FRICTION COUPLINGS FOR DRILLING AND TAPPING TOOLS, F. A. Augenthaler, 53, Mühlenstrasse, Berlin, O. 17, Germany.

In this specification it is stated that one half of the

Nº 301,483

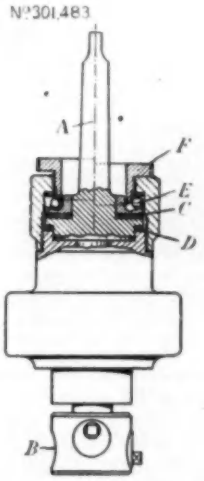


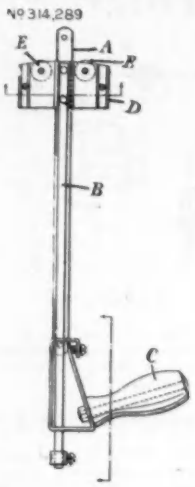

illustration shows the coupling in the operative position and the other half inoperative; but which is which is not explained. It would appear that the coupling, of the shank A to the tool holder B, is effected by the friction discs C and D, and that the parts are pressed together by the balls E being wedged out by the conically ended nut F.—*June 27th*, 1929.

314,289. October 10th, 1928.—HACK SAW FRAMES, J. J. Johnston, 1166, Alberni-street, Vancouver, B.C.

The object aimed at in this invention is to provide a hack saw which can be used to make a continuous cut in a position where the bow of an ordinary saw would be a hindrance. The saw A is placed between two guide bars, one of which is shown at B, and is worked by the handle C. At the front end of the guide

bars there is a head D, which is provided with two rollers E E. The head is so shaped as to be convenient for applying hand pressure on the top through one of the rollers on to the back of

No 314,289

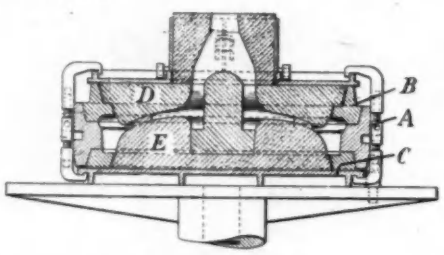



the saw. The work piece is, of course, placed in front of the head and the guides prevent the saw from buckling as it is pushed into the cut.—*June 27th*, 1929.

299,873. October 18th, 1928.—THE CENTRIFUGAL CASTING OF WHEELS, J. P. Kitteredge, 205, Euclid-avenue, Sharon, Penn.

Although the inventor states, at the end of his specification, that "among the other advantages of my invention" there lies the fact that the adoption of the centrifugal system of casting obviates the necessity for high headers to feed the mould, it

No 299,873



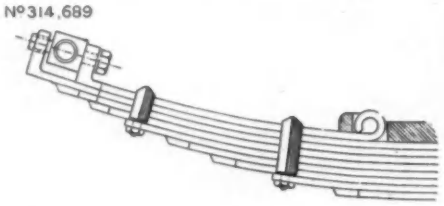

would appear that such is one of the most important claims. The wheel is cast in a mould mounted on a table which, in the case of wheels of about 26in. diameter, is rotated at a speed of from 300 to 400 revolutions per minute. The mould is provided with chills A B C which harden the tread of the wheel, while the web is formed by the sand moulds D E, that give to the metal as it shrinks in cooling. The assembly of the several parts of the mould is plainly indicated in the drawing.—*June 27th*, 1929.

## MOTOR CARS AND ROAD TRAFFIC.

314,689. July 17th, 1928.—HALF-ELLIPTIC SPRINGS, G. A. Woodhead, The Grange, Old Park-road, Roundhay, Leeds, and T. H. Sanders, 77, Cowper-street, Leeds.

It appears from this specification that the springs of commercial road vehicles, especially those of the six-wheeled type, are subject in ordinary service to severe torsional stresses, which

No 314,689



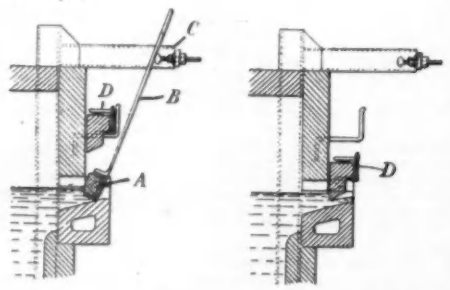
may displace the leaves of the springs, one over the other. As a consequence, the inventors furnish the two top leaves with lugs, as shown in the illustration, which provide housings for two pivots that carry a bearing round the shackle pin and thus prevent any torsional stress being transmitted from the body to the springs themselves.—*July 4th*, 1929.

## MISCELLANEOUS.

301,919. December 6th, 1928.—OUTLET STOPPERS FOR GLASS MELTING TANKS, Société Anonyme des Manufactures des Glaces et Produits Chimiques de St.-Gobain, Chauny and Cirey, 1 bis, Place des Saussaies, Paris.

The inventors explain that the usual methods of stopping the

No 301,919

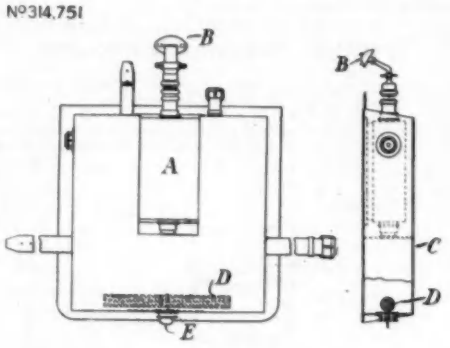



flow of glass from a melting tank are unsatisfactory in that there is a liability for the stopper to break off in the congealed glass around the outlet. They consequently use a stopper of the form shown at A, which is supported by rods B in an inclined position. The angle is adjustable at C. The top of the glass outlet is above the glass level and a slight crevice is left, so that hot gases escape from the furnace and prevent the glass congealing round the stopper. The upper lip D of the opening is adjustable to regulate the flow of glass.—*June 27th*, 1929.

314,751. November 26th, 1928.—BREATHING APPARATUS, R. H. Davis, 187, Westminster Bridge-road, London, S.E. 1.

This specification only covers a part of the design of the apparatus, but is, obviously, concerned with that type which is intended for the assistance of men escaping from submerged vessels. The apparatus is of that type in which the peroxides

No 314,751

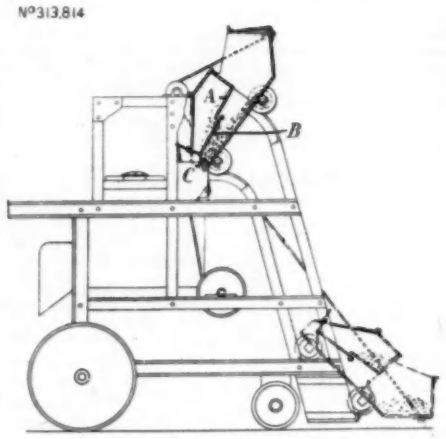



of sodium or potassium are used for the evolution of oxygen in the presence of moisture. The chemical material is contained in the canister A, which communicates with the face mask B. At the bottom of the breathing bag C there is an absorbent pad D, which is moistened with water and is inserted through the screw plug E. One of the essential features is that the pad shall be of such a form that it can be squeezed through the opening of the plug E.—*July 4th*, 1929.

313,814. September 1st, 1928.—CONCRETE MIXERS, E. R. Johnston, A. D. Collins and J. T. M. Johnston, 79, Mark-lane, London, E.C. 3.

This invention is concerned with the lifting and tipping skips used for charging concrete-mixing machines. The skip is divided into two compartments by a false bottom A, above which the cement is loaded, while the aggregate is charged in below.

No 313,814




Beyond the false bottom there is a grating B. When the skip is tipped the cement falls through the grating and is well mixed with the aggregate as the latter is moving in open formation. At the end of the grating small, loosely-hinged arms C depend into the path of the falling mass, and, being struck by the stones, agitate the grating.—*June 20th*, 1929.

## LAUNCHES AND TRIAL TRIPS.

LOCHNESS, twin-screw passenger and cargo vessel; built by Harland and Wolff, Ltd., to the order of David MacBrayne (1928), Ltd.; dimensions, 200ft. by 34ft. by 11ft. 6in.; to carry passengers and cargo. Engines, two sets triple-expansion; constructed by John G. Kincaid and Co., Ltd.; trial trip, July 9th.

SIAMESE PRINCE, twin-screw motor vessel; built by Blythswood Shipbuilding Company, Ltd., to the order of Prince Line, Ltd.; dimensions, 460ft. by 60ft. by 42¼ft.; to carry passengers and cargo. Engines, two sets Doxford opposed piston type; constructed by Richardsons, Westgarth and Co., Ltd.; launch, July 9th.

BARON RAMSAY, steel screw cargo steamer; built by D. and W. Henderson and Co., Ltd.; to the order of H. Hogarth and Sons, Ltd.; dimensions, 350ft. by 50ft. by 25ft. 9in.; to carry cargo. Engines, triple-expansion, 21½in., 37in., 62in. by 42in. stroke, pressure 210 lb. per square inch; constructed by the builders; trial trip, July 12th.

LANGLEECRAG, single-screw steamer; built by Palmers' Shipbuilding and Iron Company, Ltd.; to the order of Medomsley Steam Shipping Company, Ltd.; 9000 tons. Trial trip, July 12th.

LAURELWOOD, twin-screw Diesel-driven oil tanker; built by Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., to the order of Molasses and General Transport Company, Ltd.; dimensions, 454ft. by 59ft. by 26ft. 3in.; 10,400 tons. Engines, two sets single-acting Diesel engines; constructed by Messrs. J. G. Kincaid and Co., of Greenock; a mean speed of 12·685 knots was attained on trial trip, July 15th.

ATXURI MENDI, steamship; built by William Gray and Co., Ltd.; to the order of La Compania Naviera Sota. Y. Aznar, of Bilbao; dimensions, 289ft. by 39ft. by 18ft. 2½in.; to carry cargo. Engines, triple-expansion, 20½in., 33½in., 55in. by 39in. stroke, pressure 180 lb. per square inch; constructed by Central Marine Engine Works; trial trip, July 19th.

LUCULUS, motor vessel; built by Palmer's Shipbuilding and Iron Company, Ltd.; to the order of the "Lucigen" Steamship Company, Ltd., of Liverpool. Engines, Diesel; constructed by Wallsend Slipway and Engineering Company, Ltd.; launch, July 19th.

CINGALESE PRINCE, twin-screw motor vessel; built by Blythswood Shipbuilding Company, Ltd.; to the order of Rio Cape Line, Ltd.; dimensions, 460ft. by 60ft. by 42½ft.; to carry passengers and cargo. Engines, two sets Doxford opposed-piston type; constructed by Richardsons, Westgarth and Co., Ltd.; trial trip, July 20th.

HINDANGER, twin-screw motor cargo ship; built by Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., to the order of Messrs. Westfal-Larsen and Co. A/S, Bergen; dimensions, 415ft. by 54ft. 10in. by 36ft. 9in.; 8500 tons. Engines, two sets Burmeister and Wain-Harland and Wolff system; launch, July 23rd.

FORTHBANK, steamship; built by Workman, Clark (1928), Ltd., to the order of Messrs. Andrew Weir and Co., the Bank Line; dimensions, 436ft. by 56ft. by 36ft. 3in.; to carry cargo. Engines, quadruple-expansion, 22in., 32in., 46½in., 68in. by 48in. stroke, pressure 260 lb. per square inch; constructed by the builders; launch, July 25th.

POLZELLA, steamship; built by Wm. Gray and Co., Ltd., to the order of Eclipse Shipping and Trading Company, Ltd.; dimensions, 413ft. 6in. by 54ft. 2½in. by 27ft. 6½in.; to carry cargo. Engines, triple-expansion, 26in., 43in., 71in. by 48in. stroke, pressure 180 lb. per square inch; constructed by Central Marine Engine Works; trial trip, July 29th.

## Forthcoming Engagements.

*Secretaries, of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the* TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

**SATURDAY TO TUESDAY, AUGUST 3RD TO 13TH.**

**INSTITUTION OF ELECTRICAL ENGINEERS: LONDON STUDENTS' SECTION.—Summer Tour, 1929. The tour will be held this year in Paris and Northern France.**

**MONDAY TO SUNDAY, SEPTEMBER 9TH TO 15TH.**

INSTITUTE OF METALS.—Annual autumn meeting, Düsseldorf, Germany. Monday, September 9th, in the Aula of the Lessing Oberrealschule, Ellerstrasse, Düsseldorf, 5 p.m. Eighth autumn lecture, by Dr. A. G. C. Gwyer, B.Sc., "Aluminium and its Alloys." Tuesday, September 10th, 9.30 a.m., in the Hall of the Eisenhüttenhaus, Verein Deutscher Eisenhüttenleute, 27, Breitestr., Düsseldorf. Reading and discussion of paper (see page 66, July 19th, 1929). Wednesday, September 11th, 9.30 a.m., in the Hall of the Eisenhüttenhaus, Verein Deutscher Eisenhüttenleute, 27, Breitestr., Düsseldorf. Reading and discussion of paper (see page 66, July 19th, 1929). Thursday, September 12th, 8.15 a.m., whole-day excursion to Messrs. Krupp, Essen. Friday, September 13th, to Sunday, September 15th, visits to Berlin and Holland.

**TUESDAY TO FRIDAY, SEPTEMBER 10TH TO 13TH.**

**IRON AND STEEL INSTITUTE.—Autumn meeting at Newcastle-on-Tyne.**

**THURSDAY TO SATURDAY, SEPTEMBER 12TH TO 28TH.**

**SHIPPING, ENGINEERING AND MACHINERY EXHIBITION, Olympia.**

**SATURDAY TO SATURDAY, SEPTEMBER 14TH TO 28TH.**

**INSTITUTION OF NAVAL ARCHITECTS.—Summer meeting in Italy. For programme see page 380, April 5th, 1929.**

## PERSONAL AND BUSINESS ANNOUNCEMENTS.

ALFRED HERBERT Ltd., of Coventry, announces that it has purchased the entire business and assets of the Clyno Engineering Co. (1922), Ltd., of Wolverhampton.

SAMUEL OSBORN AND CO., Ltd., of Sheffield, ask us to announce that they have now made arrangements for stocks of their products to be kept in London by the Selby Engineering Company, Ltd., of 73–74, Chiswell-street, E.C. 1 (telephone, Clerkenwell 7483).

FERODO, Ltd., of Chapel-en-le-Frith, asks us to announce that Mr. Fred T. Rundall has retired from active management at the London branch of Ferodo, Ltd., after many years' service. He is succeeded at 222, Tottenham Court-road, W. 1, by Mr. F. L. Harrap.

MR. THOS. A. BROWN, Assoc. M. Inst. C.E., A.M.I. Mech. E., formerly chief inspecting engineer to L.N.W. Railway and L.M.S. Railway, asks us to announce that he is now in private practice as inspecting and consulting engineer, with an office on the North-East Coast and at 53, Swinderby-road, Wembley, Middlesex.

FELLOWSHIPS.—The Council of the City and Guilds of London Institute has conferred the distinction of Fellow of the Institute (F.C.G.I.) upon the following:—Mr. O. Faber, O.B.E., D.Sc., M. Inst. C.E., Mr. G. J. Gibbs, M.I.M.E., A.M.I.E.E., Mr. C. D. LeMaistre, A.M. Inst. C.E., M.I.E.E., Mr. H. J. P. O'Gorman, C.B., M. Inst. C.E., Mr. J. S. Wilson, M. Inst. C.E. The Fellowship is conferred by the Council upon those who, having obtained the associateship of the Institute and spent at least five years in actual practice, produce evidence of having done some original and valuable research work, or of having otherwise contributed to the advancement of the industry in which they are engaged.

ROBERT BLAIR FELLOWSHIPS.—The London County Council has awarded Robert Blair Fellowships to Mr. Cyril Graham Davies, of Pen-y-brin, Gorseinon, Glamorgan, and to Mr. George Low Riddell, 37, Windermere-road, Muswell Hill. Mr. Davies, who is works manager of the Grovesend Steel and Tin-plate Company, Gorseinon, will use his fellowship to carry out a detailed investigation into modern developments of practice in steel sheet, tin-plate and galvanised sheet manufacture in the United States. Mr. Riddell is the son of the Principal of the London School of Printing. He proposes to study printing and its allied trades in relation to its machinery processes and methods of production in Canada, the United States, and Germany. The Robert Blair Fellowships, which carry a grant of £450, are the most valuable awards in the gift of the London County Council.